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Whytes Gully Waste Disposal Facility

Annual Environmental Management Review 2018-2019

wollongong
city of innovation

Prepared for Wollongong City Council

October 2019

Project Number: TE19075

Wollongong City Council Approval for Release

This document was read and checked by:

- Nicole Diatloff, Senior Environmental Health Officer (Waste);
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- Joanne Page, Manager Open Space and Environmental Services.

Final Approval

Name	Position	Date	Signature
Greg Doyle	General Manager	29/10/19	

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1 Introduction

1.1 Background

Wollongong City Council (the Council) own and operate the Whytes Gully Waste Disposal Facility (Whytes Gully) located at the foothills of the Illawarra Escarpment on Reddalls Road, Kembla Grange New South Wales (NSW) (Figure 1 and Figure 2). The facility is licensed by the NSW Environmental Protection Agency (EPA) under the *Protection of the Environment Operations Act 1997* (POEO Act), Environmental Protection Licence (EPL) number 5862 (EPL 5862).

The facility is currently both managed and operated in accordance with the EPL 5862 and the *Landfill Environmental Management Plan* (LEMP) which was prepared by Golder (Golder, 2014) on behalf of the Council to ensure environmental compliance. Note: The LEMP is currently being updated, and will supersede the current LEMP.

In addition to the above, as part of the proposed expansion of the facility which included the construction of new landfill cells and leachate ponds, under *Section 75J* of the *Environmental Planning and Assessment Act 1979*, Project Approval (Approval No. 11_0094) was granted by the Minister for Planning and Infrastructure on 3 April 2013. The approval was subject to conditions stipulated in Schedules 2-5, which, among other things, requires an Annual Environmental Management Review (AEMR) report to be prepared on an annual basis, detailing the following:

(a) Operations that were carried out in the past calendar year;
(b) Monitoring results and complaint records of the project over the past year, which includes a comparison of these results against the:
    a. Relevant statutory requirements, limits or performance measures/criteria;
    b. Monitoring results of previous years; and
    c. Relevant predictions in the Environmental Assessment (EA).
(c) Details of any non-compliance over the last year, and description of what actions were (or are being) taken to ensure compliance;
(d) Trends in the monitoring data over the life of the project; and
(e) Actions proposed to be implemented over the following year to improve the environmental performance of the project (including a timeline for completion of each action).

In addition to the above, item (f) states that the Council is required to publish the report on the Council's website within two weeks of its completion.

Two modifications to Project Approval No. 11_0094 were also submitted and approved for the new landfill cell, these include:

- Modification 1 (MP11_0094 MOD 1): Modification of operating hours. Approved on 11 April 2018; and
- Modification 2 (MP11_0094 MOD 2): Modification of the eastern gully drainage channel alignment to be predominantly outside the landfill footprint. Approved on 29 May 2018.

1.2 Objectives

The objectives of this AEMR report is to satisfy the Council's Project Approval obligations for the 2018-2019 annual reporting period, being 2 March 2018 to 1 March 2019. The compiled monitoring data presented in the AEMR report addresses all of the aforementioned aspects stipulated in Section 1.1 (items (a) through to (e)).

1.3 Scope of Work

In order to achieve the objectives of the AEMR report, the following scope of work was undertaken:

- Site inspection of the facility; and
- A review and compilation of relevant information recorded by the facility pertaining to the Planning Approval conditions for the annual reporting period, including:
  - Site operations undertaken;
  - Complaints;
  - Details (including results) of all monitoring undertaken;
  - Previous monitoring results;
  - Statement of non-compliances including corrective actions implemented to ensure future compliance; and
  - Proposed actions that will be implemented for the next annual reporting period to improve environmental performance.

To assist in the preparation of this AEMR report, the following compliance documents compiled for the facility for the 2018-2019 annual period were also reviewed:

- *Whytes Gully Landfill Annual Report 2018-2019, Environmental Protection Licence 5862, Cardno, July 2019* (Cardno, 2019); and
- *Annual Return, Wollongong City Council, Licence 5862, Reporting Period 29-05-2018 to 28-5-2019* (Annual Return, 2019).

2 General Facility Operations

During the annual reporting period 2018-2019 the facility operated as per *'normal'*, in accordance with EPL 5862 and Project Approval No. 11_0094. The operating hours were Monday-Friday 0730 to 1630 and Saturday and Sunday 0800 to 1600. Details pertaining to the waste streams and volumes received are provided in Section 6.

The different areas at the facility/area of operations are shown in Figure 2 and include the following:

- Weighbridge and gatehouse;
- Community Recycling Centre;
- Transfer Station;
- Active landfilling area;
- Borrow pit area;
- Closed/Rehabilitated landfill area;
- Leachate and stormwater management and monitoring areas;
- Monitoring areas – landfill gas, groundwater and dust;
- Landfill gas flare;
- Future development areas; and
- Stockpiling areas.

In addition to the above, Stage 2 and 3 of the landfill were being constructed during this annual period, with these stages shown in Figure 2. Stage 2, package 1 and 2 was opened in January 2019, while Stage 3 was opened in March 2019.

Revegetation works and weed control commenced at the facility in March 2018 which included weed removal across the northern portion of the facility and tree planting along the Reddalls Road boundary. Weed control is ongoing, while revegetation works have since been paused due to ongoing drought conditions. Planting is forecasted to resume during the next annual period, during spring/summer following rainfall events.

3 Water Monitoring – Surface Water

Surface water (stormwater) monitoring was completed in order to satisfy Approval No. 11_0094 Schedule 4, conditions pertaining to 'Soil and Water'. The findings for the 2018-2019 annual reporting period are provided in the sections below.

3.1 Overview

Surface water monitoring was undertaken by ALS Environmental, with the monitoring locations shown in Figure 3. A summary of the monitoring requirements are detailed in Table 3-1 below:

Table 3-1: Surface Water Monitoring

<table>
<tr><th>Activity</th><th>Description</th></tr>
<tr><td>Purpose</td><td>Detect excess sediment loads in stormwater leaving the Site and/or potential cross contamination of stormwater with landfill leachate.</td></tr>
<tr><td>Frequency</td><td>Surface Water Monitoring Points: Following an overflow event (11 October 2018) and annually (11 February 2019) in accordance with EPL 5862; and
Polishing Pond: During controlled release.</td></tr>
<tr><td>Locations</td><td>Sampling locations were those listed in EPL 5862, and included the following:
Monitoring Point 1-Outlet at Reddalls Road;
Monitoring Point 33-Upstream monitoring point; and
Monitoring Point 34-Downstream monitoring point.
In addition the 'Polishing Pond' is monitored by the Council during any controlled release event.</td></tr>
<tr><td>Methodology</td><td>Samples were collected using a 'scoop'; and
Field parameters were recorded using a calibrated water quality meter.</td></tr>
<tr><td>Analytes/Field Parameters</td><td>The analysis schedule and field parameters recorded were in accordance with EPL 5862 and included:
Table 3-2: Surface Water Quality Parameters (Points 1, 33 and 34)
<table>
<tr><th colspan="3">Annually</th></tr>
<tr><td>Alkalinity</td><td>Calcium</td><td>Conductivity (EC)</td></tr>
<tr><td>Filterable iron</td><td>Magnesium</td><td>pH</td></tr>
<tr><td>Sodium</td><td>Temperature</td><td>Total phenolics</td></tr>
<tr><td>Ammonia</td><td>Chloride</td><td>Dissolved oxygen (DO)</td></tr>
<tr><td>Fluoride</td><td>Nitrate</td><td>Potassium</td></tr>
<tr><td>Sulfate</td><td>Total organic carbon (TOC)</td><td>Total suspended solids (TSS)</td></tr>
</table>
In addition, the 'Polishing Pond' was subject to analysis for pH and turbidity to ensure the water is suitable for release.</td></tr>
</table>

3.2 Performance Criteria

The performance criteria for surface water monitoring is detailed in the table below:

Table 3-3: Surface Water Performance Criteria

Description	Performance Criteria	Reference Document
Stormwater discharge	No discharge of contaminated stormwater to water under dry weather conditions[1].	EPL 5862
	No discharge of contaminated stormwater to water during a storm event of less than 1:10 year, 24 hour recurrence interval (<297.4 mm of rain within 24 hours).	
	pH: 6.5-8.5 Turbidity: 40 NTU	
Monitoring Point 1: (Reddalls Road)	pH: 6.5 to 8.5	Section 3 (L2) of EPL 5862
	TSS: 50 mg/L	

[1]*Less than 10mm of rainfall within a 24 hour period.*

In addition to the above, Section 7.4 of the LEMP (Golder 2014) states that all surface water results are to be assessed against the relevant Australia and New Zealand Environment Conservation Council (ANZECC) guidelines, specifically:

- Australian and New Zealand *Guidelines for Fresh and Marine Water Quality*, 2000, (ANZECC 2000) – Fresh Water 95% (ANZECC, 2000 FW 95%).

Note: The ANZECC, 2000 document has recently been superseded by the Australia and New Zealand and Australian State and Territory Governments (ANZAST) *Guidelines for Fresh & Marine Water Quality,* 2018 (ANZAST, 2018). However, for compliance, surface water results were compared against the ANZECC, 2000 in this instance as per the LEMP, (Golder, 2014). Following the update of the LEMP, the ANZAST, 2018 Fresh Water (95%) guidelines and/or other relevant trigger values specified in the document will be adopted during future monitoring events.

3.3 Results – Monitoring Points 1, 33 and 34

Surface water was monitored during a single stormwater overflow event (11 October 2018) and annually (February 2019) during this annual reporting period. The tabulated surface water results are provided in Appendix A, with a summary of the results presented in the sections below.

3.3.1 TSS and pH

The recorded TSS concentrations were below the threshold, and pH was within the specified performance criteria range. Whilst all locations were in compliance, during the winter sampling event, it would appear that there was an increase in TSS and pH at the discharge sampling point when

compared to the upstream sampling point. At the Downstream sampling point, TSS was noted to decrease to a level in line with the upstream sampling point, whilst pH remained similar to the discharge sampling point. A similar trend was noted during the summer sampling event. This suggests that small changes to the surface water body quality were noted at the discharge location. The reported concentrations for the winter and summer sampling event were as follows:

Table 3-4: Surface Water Results

Monitoring Point	Sampling Event	Concentrations	Performance Criteria
Discharge Point (Monitoring Point 1)	11/10/2018	TSS: 27 mg/L pH: 8.3	TSS: 50 mg/L pH: 6.5-8.5
	11/02/2019	TSS: 21 mg/L pH: 7.8	
Upstream (Monitoring Point 33)	11/10/2018	TSS: <5 mg/L pH: 7.5	N/A
	11/02/2019	TSS: 10 mg/L pH: 7.1	
Downstream (Monitoring Point 34)	11/10/2018	TSS: 5 mg/L pH: 8.3	
	11/02/2019	TSS: 9 mg/L pH: 7.4	

3.3.2 All other parameters

3.3.2.1 Nutrients and TOC

No trigger values are specified within the ANZECC, 2000 FW 95% guidelines for these compounds, with the exception of nitrate. Nitrate concentrations were reported below the adopted assessment criteria (0.7 mg/L), with concentrations ranging between <0.01 mg/L (Upstream, Monitoring Point 33 (11/02/2019)) and 0.34 mg/L (Discharge Monitoring Point 1 (11/10/2018). Ammonia, which is a compound associated with landfill leachate, was reported at low concentrations at all sampling points, though were marginally higher at Discharge Monitoring Point 1.

TOC, which can be used as a general water quality indicator, reported higher concentrations at Discharge Monitoring Point 1, with lower concentrations reported at both the Upstream and Downstream Monitoring Points (33 and 34). This may indicate a small level of influence at the sampling point which can be contributed to the facility, though this is not being carried through to the downstream sampling point. It also appears that higher concentrations were reported at the discharge point during the stormwater overflow sampling event (11/10/2018), compared to the annual event (11/02/2019). This suggests a slight increase in discharge during the storm event, which is to be expected.

In general, TOC and nutrient concentrations were lowest at the upstream sampling point (Monitoring Point 33). Concentrations slightly increase at the discharge sampling point (Monitoring Point 1), then

slightly decrease at the downstream sampling point (Monitoring Point 34), to concentrations similar to the upstream monitoring location. Again, this suggests that the discharge point is having some level of influence on surface water quality at this location.

3.3.2.2 Major Anions and Cations

No trigger values are specified in the ANZECC, 2000 FW 95% guidelines for anions and cations, but their inclusion allows for an understanding of water characteristics and whether these characteristics are changing between monitoring points.

Overall, concentrations of anions and cations at Discharge Monitoring Point 1 and Downstream Monitoring Point 34 were similar, with lower concentrations of calcium, chloride, fluoride, magnesium, potassium, sodium, sulfate and alkalinity reported at the upstream point. It appears that the facility may be causing a slight change in water facies downstream.

3.3.2.3 Electrical Conductivity

No trigger values are specified in the ANZECC, 2000 FW 95% guidelines for EC, though its inclusion allows for an understanding of water quality and possible impacts to this quality.

The measured EC varied across the three locations ranging between 201 µS/cm (Upstream Monitoring Point 33) and 973 µS/cm (Discharge Monitoring Point 1). Overall, EC was lowest at the Upstream Monitoring Point 33 and the highest at the Discharge Point. Based on the EC values, the water appears to be '*fresh*'.

3.3.2.4 Filterable Iron

No trigger values are specified in the ANZECC, 2000 FW 95% guidelines for filterable iron.

Low detectable concentrations were reported at all locations during both sampling events. Concentrations were reported to range between 0.09 mg/L (Downstream Monitoring Point 34 (11/02/2019)) and 1.28 mg/L (Discharge Monitoring Point 1 (11/10/2018). Overall, values were consistent across all locations, and sampling dates with the exception of the storm event which reported an increase in filterable iron at Discharge Monitoring Point 1.

3.3.2.5 Dissolved Oxygen and Temperature

Reported DO concentrations ranged between 4.31 mg/L (11/02/2019) and 11 mg/L (11/10/2018) which were both reported at the Downstream Monitoring Point 34.

Overall, higher DO concentrations were reported during the stormwater overflow event (11/10/2018), compared to the annual event (11/02/2019). This is likely associated with the storm event increasing aeration, and the higher temperature reducing DO saturation during the summer months.

Temperature was generally consistent between monitoring points, with lower temperatures recorded during on 11/10/2018 compared to 11/02/2019. This is considered to be associated with a seasonal change (spring and summer).

3.3.2.6 Total Phenolics

Total phenolics (phenols) were reported below the laboratory practical quantification limits (PQLs) at all Monitoring Points (1, 33 and 34) during both sampling events.

3.4 Results – Polishing Pond

The tabulated results for the Polishing Pond are provided in Appendix A.

The Polishing Pond was subject to testing for pH and turbidity prior to, and during controlled release events. Controlled release is undertaken to allow the sediment pond capacity to be maintained to increase storage of stormwater during rainfall events.

The aforementioned parameters were measured on 35 occasions, while controlled release occurred on 23 occasions where pH was within the suitable range (6.5-8.5), and turbidity was <40 NTU.

3.5 Conformances

In reference to surface water monitoring, the facility showed conformances during the 2018-2019 annual reporting period.

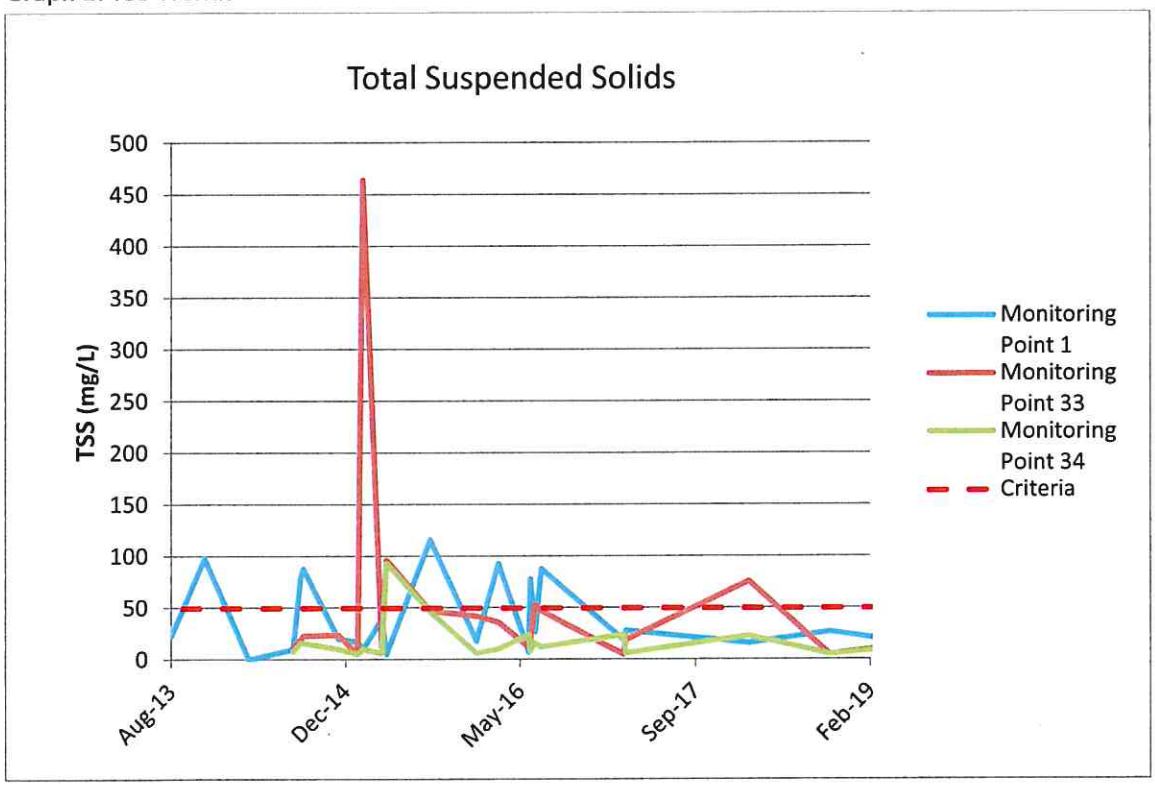
3.6 Monitoring Trends

The graphed TSS and pH values for the period 2013-2019 are provided below, while all the other analytes subject to monitoring during the same period are provided in Appendix A. A summary of the observable trends are provided below.

3.6.1 TSS Trends

As shown in the graph below, TSS concentrations have generally exceeded the performance criteria (50 mg/L), with a large spike (464 mg/L) observed at Upstream Monitoring Point 33 in 2015. Concentrations at monitoring points have generally been reported below 100 mg/L during all other monitoring events. It appears that since mid-2016 concentrations have shown a decreasing trend, with the exception of Upstream Monitoring Point 33 which showed a slight spike in 2018, however, it dropped below the performance criteria in 2019. Importantly, concentrations at Discharge Monitoring Point 1 and Downstream Monitoring Point 34 have been below the adopted performance criteria since 2016.

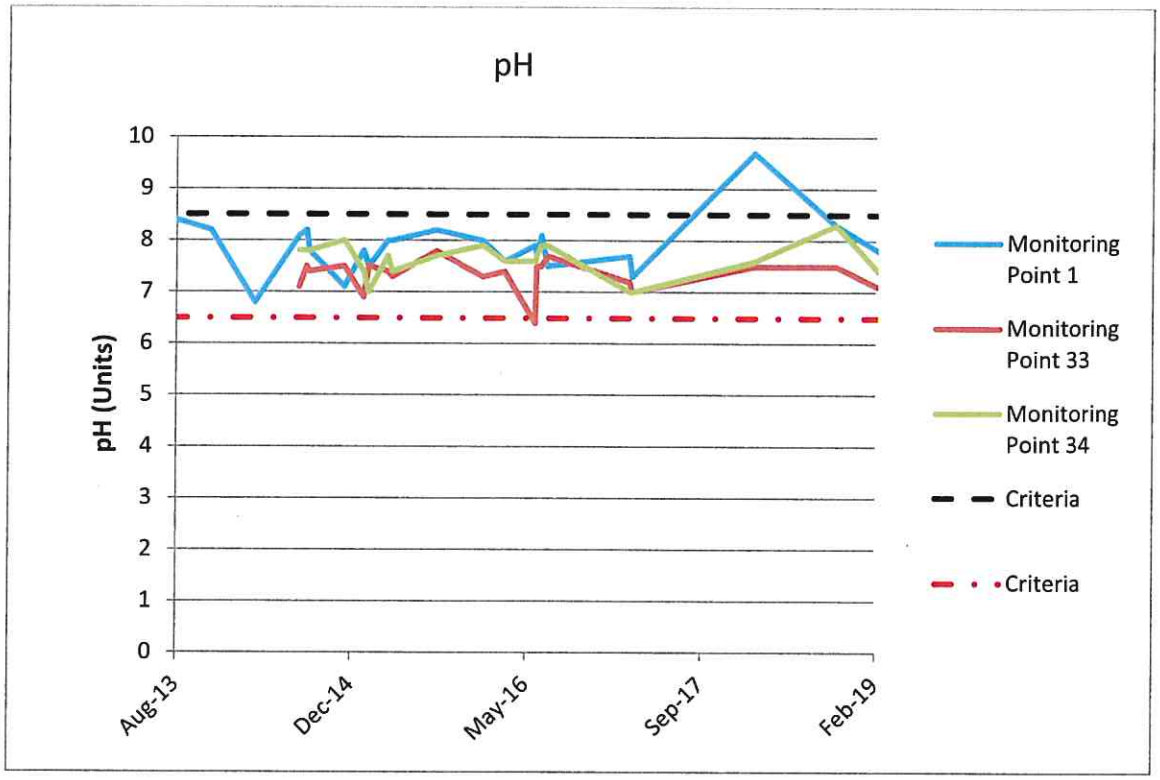
Graph 1: TSS Trends



3.6.2 pH Trends

As shown in the graph below, pH has largely been stable, with minor fluctuations noted but generally within the acceptable performance criteria. A spike was recorded at Discharge Monitoring Point 1 in 2018, where the water's alkalinity increased, pushing the pH up to 9.7. This appears to be an isolated event, as the pH value returned to within performance criteria, and general trends, during the next sampling event.

Graph 2: pH Trends



3.6.3 All Other Parameters

In relation to all other parameters monitored, the following trends were observed for the period 2013-2019, while the trend graphs are provided in Appendix A.

Nutrients: Nitrate concentrations generally exceeded the ANZECC, 2000 FW 95% assessment criteria prior to 2016, with highest reported concentrations at Discharge Monitoring Point 1-similar to this annual period. Since 2016, concentrations have decreased to below the FW 95% assessment criteria.

In relation to all remaining nutrients, concentrations have generally shown a similar decrease since 2016.

TOC: Concentrations have generally remained stable, with Discharge Monitoring Point 1 spiking in 2013, and further small spikes reported a Discharge Monitoring Point 1 and 33 in 2018.

Major Anions and Cations, and EC: Concentrations generally appear to be stable across the monitoring events. A large spike in fluoride concentrations was observed in 2014, whereas alkalinity, EC, calcium, chloride, magnesium, sodium and sulfate were noted to spike in May 2016, with a second spike in sodium concentrations noted 2018.

Filterable Iron: Concentrations generally appear to be stable, with minor fluctuations. A large spike at Downstream Monitoring Point 33 was however noted in 2013.

Dissolved Oxygen: Concentrations appear to fluctuate significantly across all locations. This correlates with higher DO saturation during overflow events, and lower DO saturation during annual sampling events-again, a result that is to be expected.

Temperature: The temperature appears to fluctuate significantly across all locations, again, correlating with winter/spring and summer seasons.

Total Phenolics: Concentrations at all locations during each monitoring event have consistently been reported below the laboratory PQLs.

3.7 EA Predictions

The EA did not provide predictions pertaining to surface water.

4 Water Monitoring - Groundwater

Groundwater monitoring was completed in order to satisfy Approval No. 11_0094 Schedule 4, conditions pertaining to 'Soil and Water'. The findings for the 2018-2019 annual reporting period are provided in the sections below.

4.1 Overview

Groundwater monitoring was undertaken by ALS Environmental, with monitoring locations shown in Figure 4. A summary of the monitoring requirements are detailed in the table below:

Table 4-1: Groundwater Monitoring

Activity	Description
Purpose	Detect if groundwater is impacted by leachate.
Frequency	Quarterly in accordance with EPL 5862. Monitoring was completed in: • May 2018; • August 2018; • November 2018; and • February 2019.
Locations	Sampling locations were in accordance with EPL 5862, and included the following Monitoring Points: 5, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19 and 20.
Methodology	Prior to sampling, the standing water levels (SWLs) were measured using a water level meter; Groundwater samples were collected using a *'bailer'*; and Field parameters were recorded using a calibrated water quality meter prior to sampling.
Analytes/Field Parameters	The analysis schedule was in accordance with M2.3 of EPL 5862 and included:

Table 4-2: Groundwater Parameters

Annually	Quarterly
Metals: aluminium, arsenic, barium, cadmium, chromium (hexavalent and total), cobalt, copper, lead, manganese, mercury and zinc	Alkalinity
Benzene, toluene, ethylbenzene and xylene (BTEX)	Major anions and cations: calcium, magnesium, potassium, sodium, chloride, sulfate
Fluoride	pH and EC
Nitrate and nitrite	SWLs
Organochlorine and organophosphate (OC and OP) pesticides	Total dissolved solids (TDS)

Activity	Description	
	Polycyclic aromatic hydrocarbons (PAH)	TOC
	Total petroleum hydrocarbons (TRH)	Nitrogen-(ammonia)
	Total phenolics	

4.2 Performance Criteria

Consistent with the surface water monitoring performance criteria, Section 7.4 of the LEMP (Golder 2014) states that all groundwater results are to be assessed against the relevant ANZECC, 2000 guidelines, specifically:

- ANZECC, 2000 FW 95%

Note: Following the update of the LEMP, the ANZAST, 2018 Fresh Water (95%) guidelines and/or other relevant trigger values specified in the document will be adopted during future monitoring events.

4.3 Results

4.3.1 Standing Water Levels

Groundwater was anticipated to flow in a south-westerly direction. The minimum and maximum recorded SWLs (meters below top of casing (m bToC) were as follows:

Table 4-3: Standing Water Levels

Monitoring Event	Minimum depth (m bToC)	Maximum depth (m bToC)
May 2018	1.77 m (Monitoring Point 20)	7.90 m (Monitoring Point 11)
August 2018	2.03 m (Monitoring Point 20)	5.88 m (Monitoring Point 18)
November 2018	1.67 m (Monitoring Point 20)	8.06 m (Monitoring Point 11)
February 2019	1.63 m (Monitoring Point 20)	7.95 m (Monitoring Point 11)

Monitoring Points 9, 12 and 13 were noted to be dry.

4.3.1.1 pH and EC

Groundwater pH was reported to be relatively neutral across the groundwater monitoring well network, range between pH 6.2 (Monitoring Point 16, 14/08/2018) and pH 7.4 (Monitoring Pont 11, 14/08/2018).

EC was reported to range between 1,180 µS/cm (Monitoring Point 20, 11/02/2019) and 5,490 µS/cm (Monitoring Point 5, 8/11/2018), suggesting the water is *'fresh'* to *'brackish'*.

4.3.2 Laboratory Analysis Results

Tabulated analysis results for the 2018-2019 annual reporting period are provided in Appendix B, with a summary of the results presented in the following sections.

4.3.2.1 Metals

Metals were detected in groundwater at all sampling locations, with concentrations of arsenic, barium, cadmium, chromium, cobalt, lead and mercury below the ANZECC, 2000 FW 95% assessment criteria. However, the following exceedances of the ANZECC, 2000 FW 95% assessment criteria were reported:

Table 4-4: Metals Exceedances

Metals	Monitoring Point	Exceedances (mg/L)	Assessment Criteria ANZECC, 2000 FW 95% (mg/L)
Aluminium	5	6.61 (11/02/2019)	0.055
	10	3.19 (11/02/2019)	
	11	7.56 (14/08/2018); and 12.6 (11/02/2019)	
	14	11.9 (11/02/2019)	
	15	0.09 (11/02/2019)	
	16	3.7 (14/08/2018); 5.68 (08/11/2018); and 2.31 (11/02/2019)	
	17	2.29 (11/02/2019)	
	18	6.29 (11/02/2019)	
	19	0.05 (11/02/2019)	
	20	0.65 (11/02/2019)	
Copper	5	0.015 (11/02/2019)	0.0014
	14	0.039 (11/02/2019)	
	16	0.018 (14/08/2018); and 0.016 (08/11/2018)	
	18	0.016 (11/02/2019)	
Manganese	16	4.62 (14/08/2018); 3.93 (08/11/2018); and 1.33 (11/02/2019)	1.9
Zinc	16	0.109 (14/08/2018); and 0.074 (08/11/2018)	Modified for hardness criteria (0.072)

4.3.2.2 Hydrocarbons

Concentrations of BTEX, TRH, PAH and total phenolics (total phenols) were reported below the laboratory PQLs and below the adopted assessment criteria.

Of note, the anthracene PQL (0.001 mg/L) was higher than the ANZECC, 2000 FW 95% (0.0004 mg/L) trigger value and, as such, an exceedance may be masked.

4.3.2.3 Major Anions and Cations

Concentrations of calcium, magnesium, potassium, chloride, fluoride, sulfate and sodium varied across the groundwater well network. It however appears that groundwater is dominated by calcium, sodium and chloride ions, with all groundwater wells exhibiting higher concentrations of these ions compared to the others.

Groundwater beneath the facility is also described as very hard to extremely hard. Monitoring Point 2, consistently reported the highest $CaCO_3$ concentrations during the annual period, ranging between 983 mg/L (22/05/2018) and 1,210 mg/L (8/11/2018), whereas the lowest $CaCO_3$ concentrations were generally reported at Monitoring Point 16, with concentrations ranging between 211-266 mg/L (during the 14/08/2018 and 22/05/2018 monitoring events respectively).

4.3.2.4 TDS

Groundwater across the Site was reported to be *'fresh'* to '*brackish*', with TDS concentrations ranging between 744 mg/L at Monitoring Point 11 (11/08/2018) and 3,380 mg/L at Monitoring Point 5 (8/11/2018).

4.3.2.5 TOC

No trigger values were adopted for TOC as none exists within the ANZECC, 2000 guidelines. Concentrations at Monitoring Point 19 were reported below the laboratory PQL during each sampling event (<1 mg/L), whereas highest concentrations were reported at Monitoring Point 20, with concentrations ranging between 6 mg/L (11/08/2018) and 31 mg/L (8/11/2018).

4.3.2.6 OC and OP Pesticides

OC and OP pesticides were reported below the laboratory PQLs during the annual monitoring event (19/02/2019). It was however noted that several PQLs were higher than the ANZECC, 2000 guideline values, and as such, some exceedances may be masked. These increased PQLs are shown in the table below:

Table 4-5: High PQLs

Analyte	PQL (mg/L)	Date	Assessment Criteria (mg/L) – ANZECC, 2000 FW 95%
Chlordane	0.0005	19/02/2019	0.00008
DDT	0.002		0.00001
Endrin	0.0005		0.00002
g-BHC (Lindane)	0.0005		0.0002
Heptachlor	0.0005		0.00009

Analyte	PQL (mg/L)	Date	Assessment Criteria (mg/L) – ANZECC, 2000 FW 95%
Azinophos methyl	0.0005	19/02/2019	0.00002
Chlorpyrifos	0.0005		0.00001
Diazinon	0.0005		0.00001
Dimethoate	0.0005		0.00015
Malathion	0.0005		0.00005
Parathion	0.002		0.000004

4.3.2.7 Nutrients

Nutrient concentrations including nitrate, nitrite, and ammonia-N concentrations were reported below the adopted assessment criteria at all locations. Monitoring Point 16 and 20, located adjacent to the surface water ponds, exhibited marginally higher concentrations of all nutrients.

4.4 Conformances

In relation to groundwater, the monitoring schedule was in conformance during the 2018-2019 annual reporting period. However, in relation to concentrations of contaminants of potential concern (COPCs) in groundwater, the following non-conformances were reported:

- Raised OC/OP PQLs which may potentially mask exceedances in the adopted assessment criteria; and
- Metals exceedances (aluminium, copper, manganese and zinc) at several locations. However, based on previous monitoring data, it appears that aluminium and copper appear to be regionally elevated. Appears that the facility may be contributing to manganese and zinc, however a decline of these analytes has been reported across a number of monitoring events undertaken.

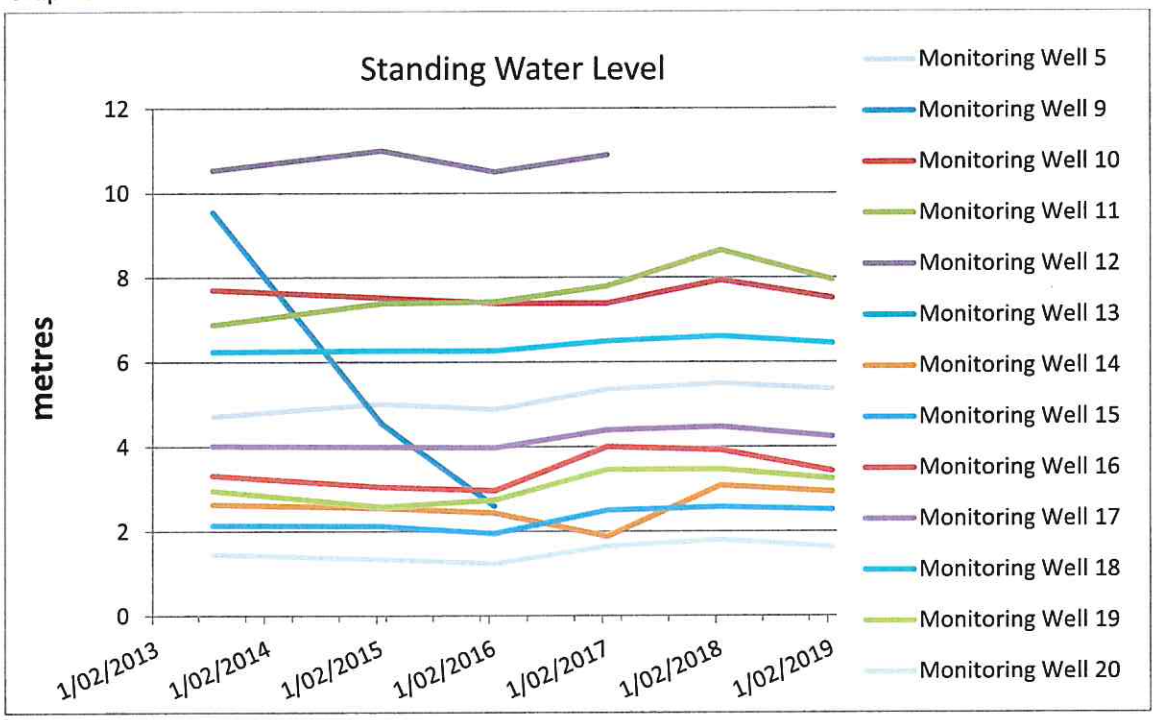
4.5 Monitoring Trends

The graphed monitoring trends for groundwater SWLs, TOC, ammonia-N and metals including aluminium, arsenic, copper, cadmium and zinc for the period 2013-2019 are provided below. The full suite of graphed trends for the same period are provided in Appendix B, with a summary of observable trends provided below. Note: Monitoring Points 9, 12 and 13 were dry since 2016/2017.

4.5.1 SWLs

SWLs have generally remained consistent across the monitoring period, excluding Monitoring Point 9 which had a large decline between 2014 and 2016, and since 2016 has been dry. For the most part, the greatest depth to groundwater was recorded at Monitoring Point 12, until it was recorded as dry in 2018, followed by Monitoring Point 11. Groundwater depth was shallowest at Monitoring Point 20.

Graph 3: SWL Trends

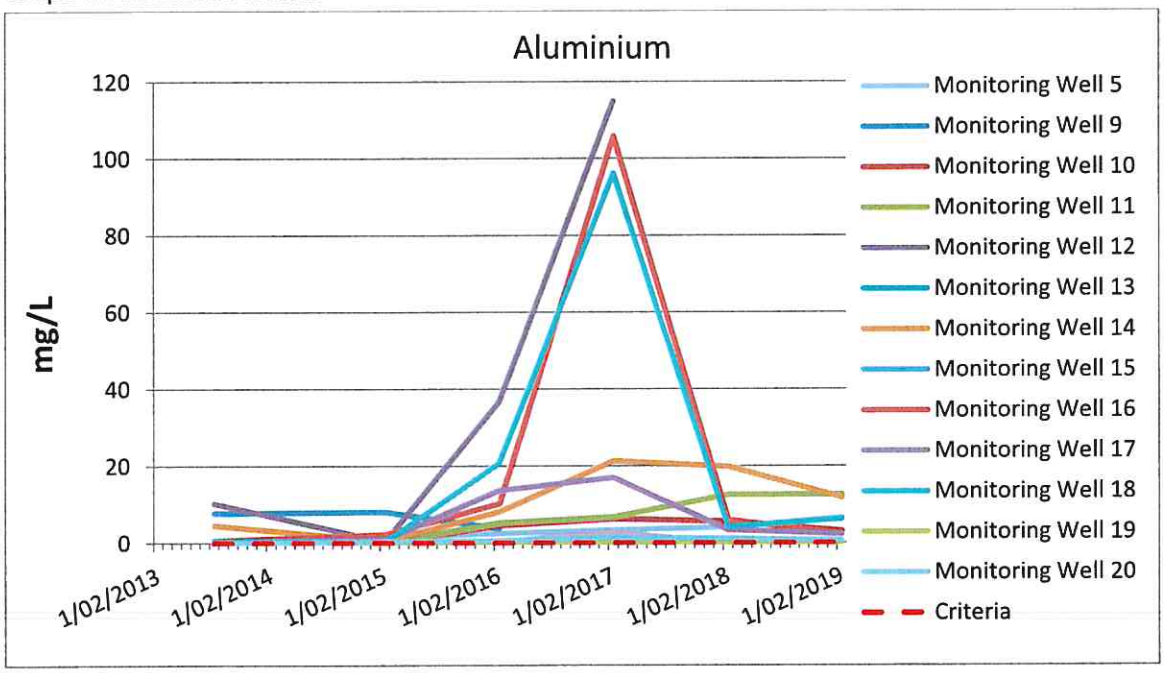


4.5.2 Metals

Aluminium

As shown in the graph below, aluminium concentrations have generally been stable with a large spike reported at Monitoring Point 12, 16 and 18 in February 2017, which returned to long term trends after this event. Concentrations have generally been in exceedance of the adopted assessment criteria.

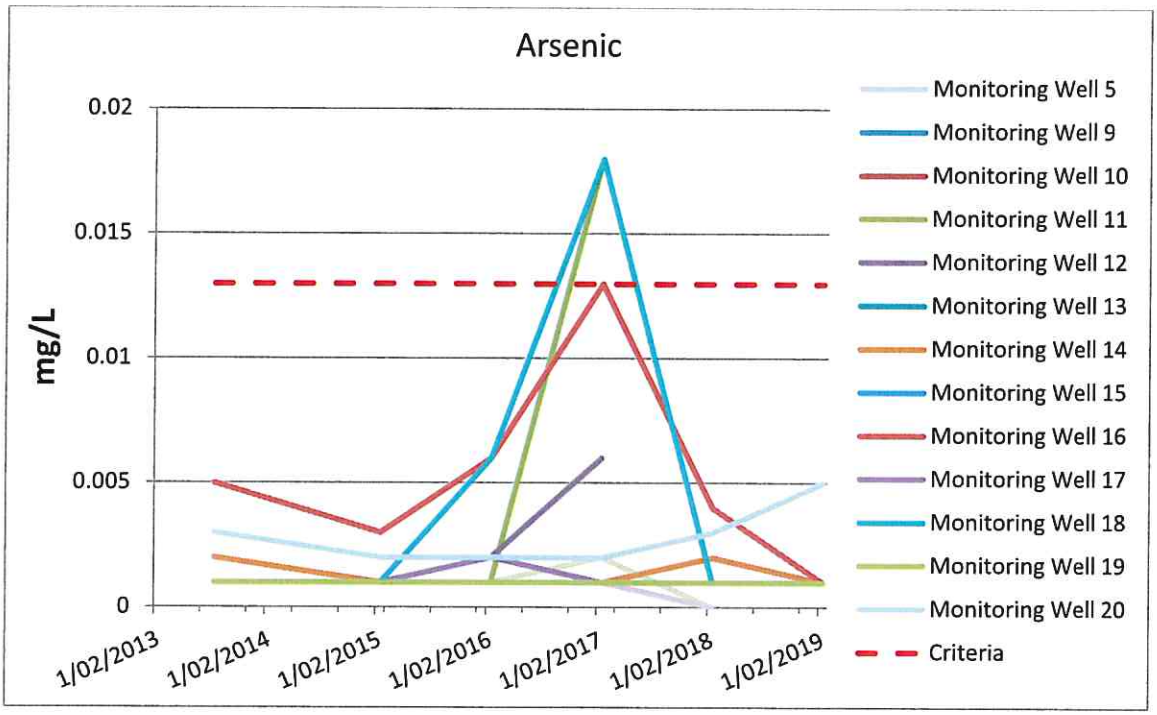
Graph 4: Aluminium Trends



Arsenic

As shown in the graph below, arsenic concentrations have slightly fluctuated but have generally been reported below the adopted assessment criteria. This was excluding a large spike in concentrations reported, again, during the February 2017 sampling event at Monitoring Point 11, 12, 16 and 18, which caused Monitoring Point 11 and 18 to exceed the adopted assessment criteria at this time. This appears to have been an isolated event, and concentrations returned to their long term trend following this sampling event.

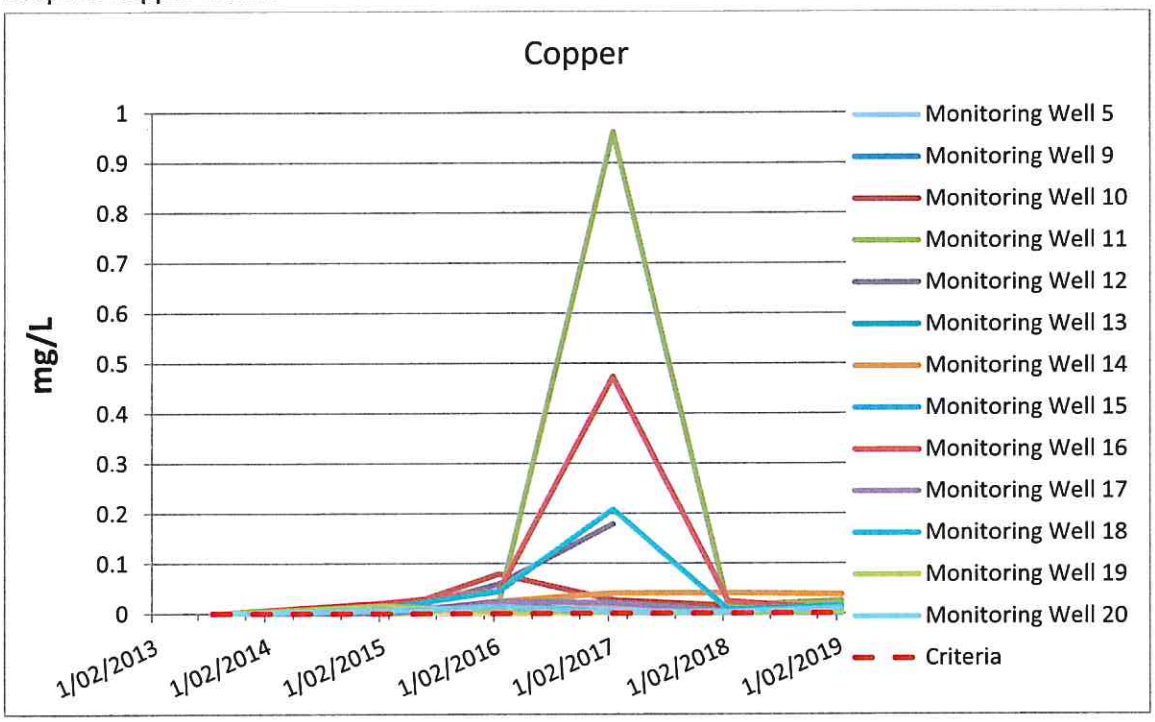
Graph 5: Arsenic Trends



Copper

As shown in the graph below, copper concentrations have generally exceeded the adopted assessment criteria. Again, a large spike was reported at Monitoring Point 11, 12, 16 and 18 in February 2017, following which they returned to their long term trends.

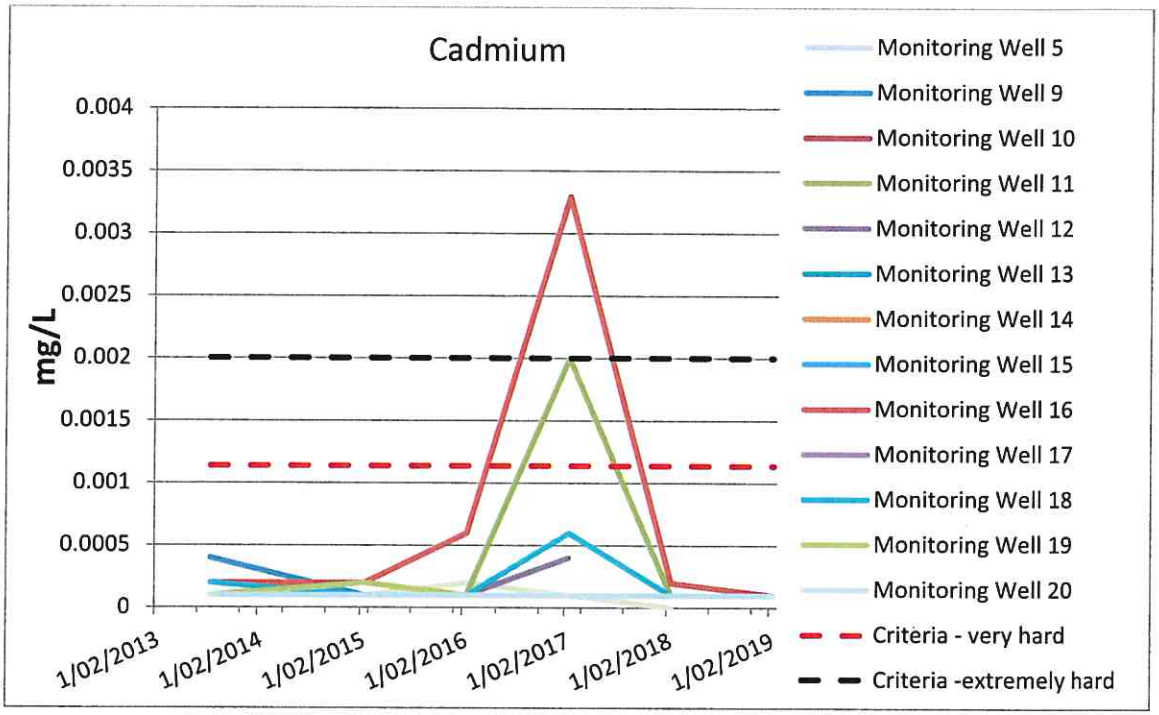
Graph 6: Copper Trends



Cadmium

The guideline values for cadmium were corrected to account for water hardness. As shown in the graph below, cadmium concentrations have generally been stable and below the adopted assessment criteria, again, excluding a spike in concentrations reported at Monitoring Point 11, 12, 16 and 18 in February 2017. Following this, concentrations at the monitoring points returned to their long term trends. Groundwater at Monitoring Point 16 is very hard, with concentrations exceeding both the very hard and extremely hard water assessment criteria for cadmium during this event. Groundwater at Monitoring Point 19 has ranged between very hard and extremely hard, and during the same event, concentrations only exceeded the very hard assessment criteria. Concentrations at all locations have however fallen below the adopted assessment criteria.

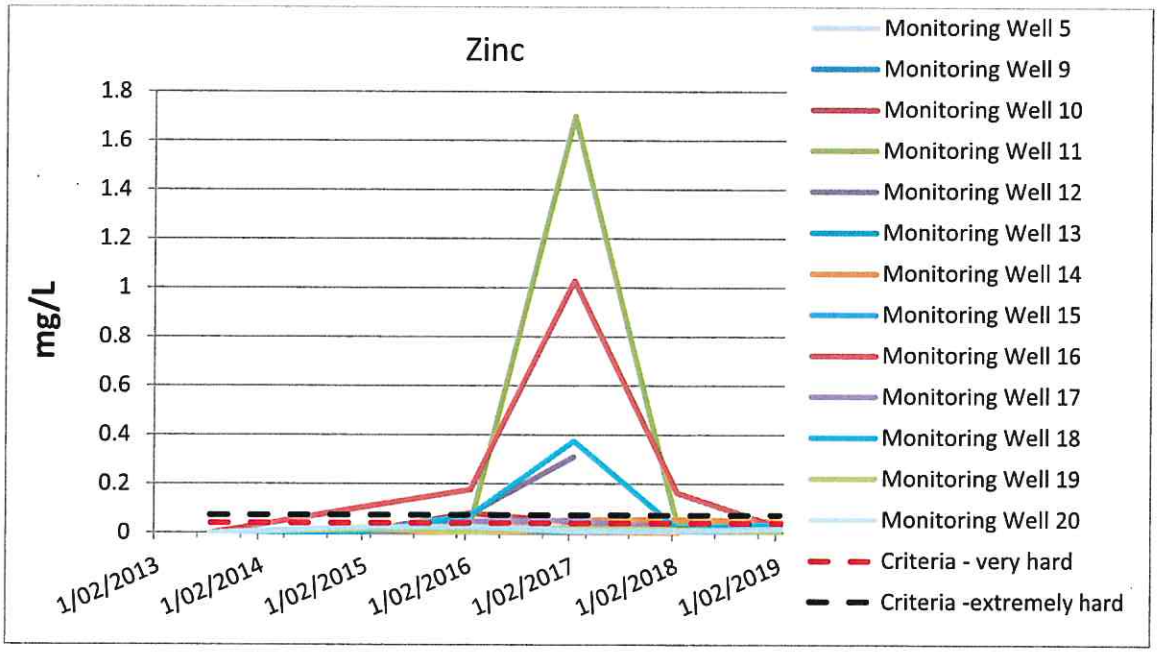
Graph 7: Cadmium Trends



Zinc

The guideline values were corrected for water hardness. As shown in the graph below, zinc concentrations have generally been stable and reported below the adopted assessment criteria, excluding a similar spike noted at Monitoring Point 11, 12, 16 and 18 in February 2017. Concentrations at these locations exceeded the very hard and extremely hard assessment criteria during the February 2017 event, however have fallen below the adopted assessment criteria.

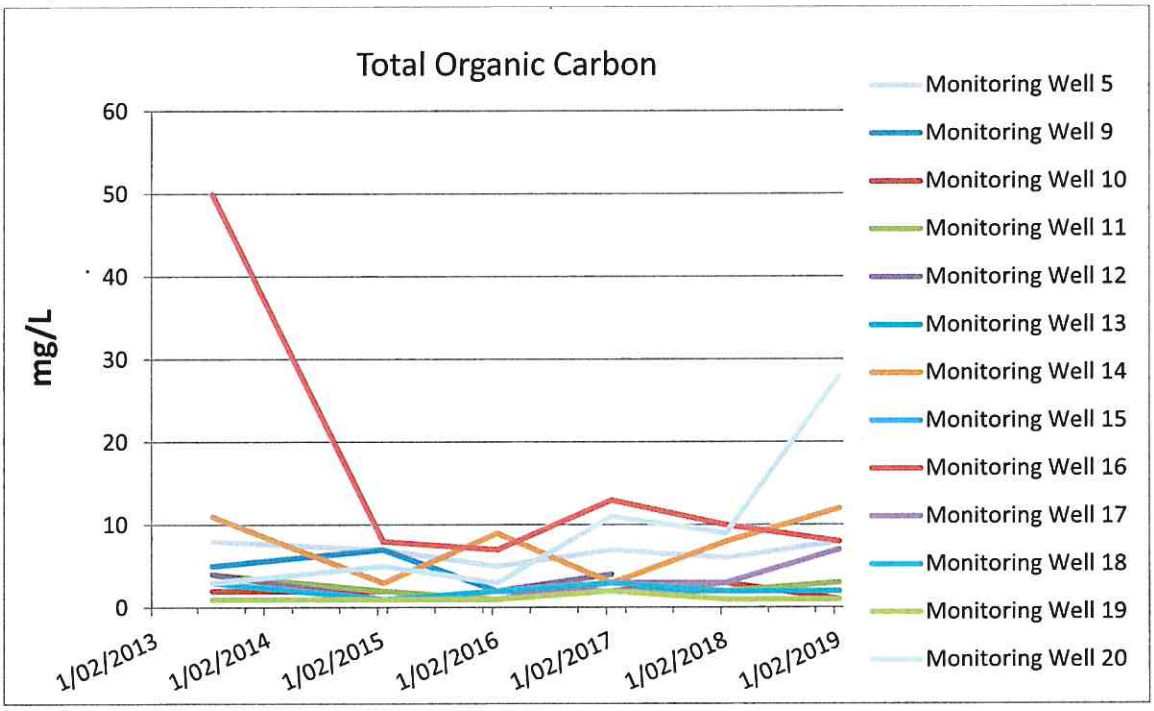
Graph 8: Zinc Trends



4.5.3 TOC

As shown in the graph below, TOC concentrations have been relatively stable, with an overall slight increase in concentrations noted between 2018 and 2019. This is with the exception of Monitoring Point 16, which has shown a large decrease between 2013 and 2015 before stabilising; and a large increase at Monitoring Point 5 between 2018 and 2019. Again, a slight increase from long term trends can be seen during the February 2017 sampling event.

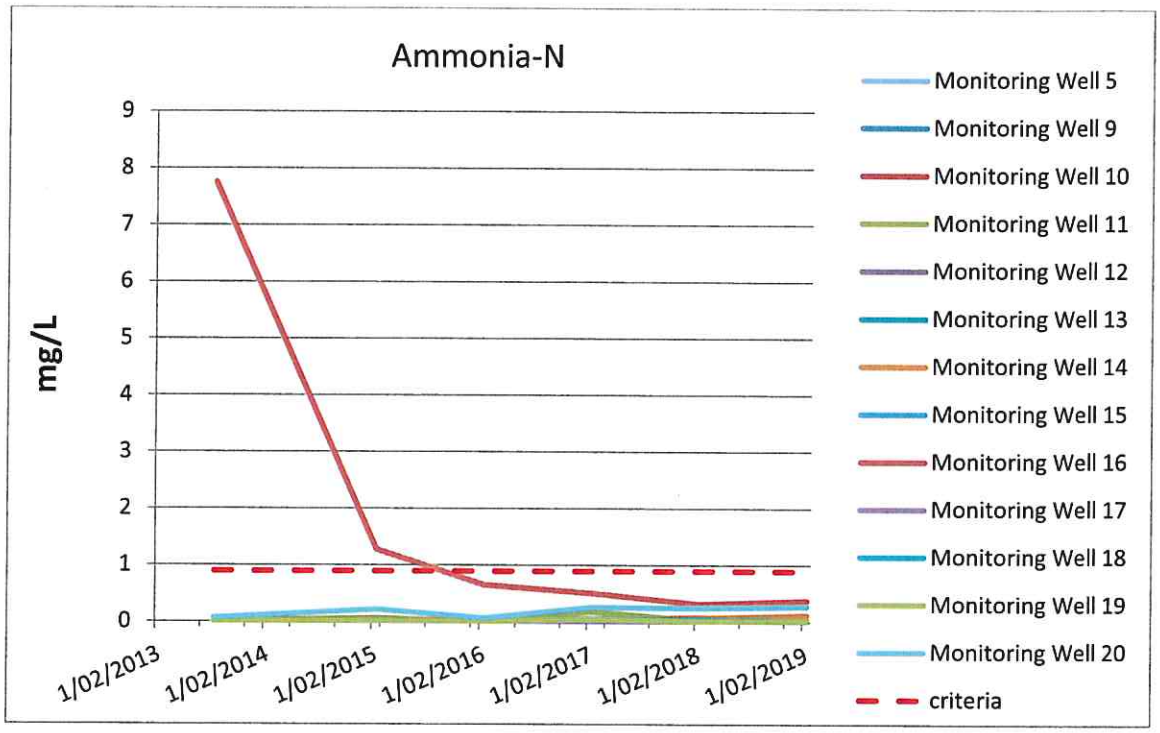
Graph 9: TOC Trends



4.5.4 Ammonia-N

As shown in the graph below, ammonia-N was reported below the adopted assessment criteria during all monitoring events, excluding Monitoring Point 16 prior to 2016. Concentrations at Monitoring Point 16 have significantly decreased since 2016.

Graph 10: Ammonia-N Trends



4.5.5 Other Analytes

The full suite of graphed trends for the same period are provided in Appendix B, with a summary of observable trends provided below.

Major Anions and Cations: Concentrations have been subject to minor fluctuations across the monitoring period, excluding Monitoring Point 14 which reported variations in the concentrations of fluoride, potassium, sodium and sulfate. In addition, between 2018 and 2019, a large decrease in sodium and sulfate, and an increase in potassium was noted at Monitoring Point 20.

TDS: Concentrations vary across the monitoring well network, with highest reported concentrations at Monitoring Point 5 (with concentrations generally in exceedance of 3,000 mg/L), and lowest (<500 mg/L) at Monitoring Point 9 and Monitoring Point 12 (before they dried up).

Nutrients: Concentrations of nutrients have generally remained stable with the exception of nitrate-N which showed a spike in 2015 at Monitoring Point 12, though concentrations of nitrate-N were below the adopted assessment criteria at all locations during each monitoring event.

pH: pH in groundwater is generally neutral, ranging between 6.5 and 7.5 across the monitoring period excluding Monitoring Point 12, which exhibited a low pH, ranging between 5.3 (2013) and 5.9 (2017), and Monitoring Point 16. Monitoring Point 12 has however been dry since 2017. The lower pH value may be a result of the sampling technique, or some influence from the well not being installed to a adequate depth to allow for the development of a sufficient water column for sampling. Excluding the 2018 monitoring period, groundwater pH at Monitoring Point 16 has been reported marginally outside the lower pH performance criteria, with pH ranging between 6.1 (6/02/2017) and 6.4 (5/02/2016).

EC: EC was shown to be relatively stable across the monitoring periods. This is with the exception of Monitoring Point 14, which has been subject to large fluctuations. A slight increase was also noted across the monitoring period at Monitoring Points 5, 11, 17 and 18 during 2019, while a large decrease was noted at Monitoring Point 20 in 2019.

OC and OP Pesticides: Concentrations were reported below the laboratory PQLs during all monitoring events.

PAH: Concentrations were reported below the laboratory PQLs during all monitoring events.

BTEX: Concentrations were reported below the laboratory PQLs during all monitoring events.

Total Phenolics: Concentrations were reported below the laboratory PQLs during all monitoring events.

4.6 EA Predictions

The EA predictions were that leachate migration into groundwater would be controlled via the permeability of the landfill liner. Additionally, no high value groundwater dependent ecosystems are located within the vicinity of the facility, and the landfill would present a relatively low risk in the event that leachate did migrate to groundwater. The EA predications are particularly evident due to low nutrient (ammonia-N) concentrations reported in groundwater, compared to those concentrations detected in the collected leachate samples (Section 5.3.2).

Based on the overall groundwater assessment, results have generally confirmed the EA predictions, with the exception of possible metals impacts identified at a single location. Historical groundwater flow regime at the Site was noted to be in a south/south-westerly direction. Based on this anticipated groundwater flow direction, it appears that there are some minor manganese and zinc impacts to groundwater at Monitoring Point 16, which is located down-hydraulic gradient from the surface water ponds. Elevated concentrations of aluminium and copper were also reported at Monitoring Point 16, however it appears that aluminium and copper are regionally elevated in groundwater with exceedances also reported in groundwater wells located hydraulically-up gradient from the landfill waste mass on a number of occasions.

Of note, previously, prior to the 2015 monitoring event, Monitoring Point 16 appeared to be highly impacted by leachate, with high concentrations of nutrients, and TOC reported. This issue was rectified via improvements to the stormwater ponds and improvements to the operation of the leachate treatment facility, consequently, concentrations of nutrients and TOC in groundwater have significantly reduced and stabilised.

5 Waste Monitoring – Trade Wastewater and Leachate

Sampling of trade wastewater and leachate was undertaken in order to satisfy Approval No. 11_0094 Schedule 4, conditions pertaining to 'Waste'. The findings for the 2018-2019 annual reporting period are provided in the sections below.

5.1 Overview

Trade wastewater and leachate sampling was undertaken by ALS Environmental in accordance with the *Consent to Discharge Industrial Trade Wastewater* (Sydney Water, 2017). The monitoring locations are shown in Figure 5. A summary of the monitoring requirements is detailed in the table below.

Table 5-1: Trade Wastewater

Activity	Description
Purpose	**Trade Wastewater:** Confirm quality of wastewater discharged from the facility. **Leachate:** Chemically characterise the leachate to allow assessment of potential environmental harm and impacts.
Frequency	**Trade Wastewater:** On 16 March 2018 and every 22 days thereafter. If trade wastewater was not discharged on a scheduled day, then sampling was taken the next day when trade wastewater was discharged[1]. **Leachate:** On 5 March 2018 and every week thereafter.
Locations	Sampling locations were in accordance with *Sydney Water, 2017,* and included the Eastern Arm Collection Well, Balance Tank and Trade Wastewater (locations are depicted as Leachate Treatment Plant in Figure 5). In addition sampling was also undertaken at leachate Ponds P1 and S1.
Methodology	**Trade Wastewater:** Composite samples were collected over a 24 hour period using a Composite Autosampler, while grab samples were collected pre and post monitoring; The composite samples were collected over one full production day by combining equal volumes taken at 30 minute intervals. The volumes collected were at least 5 L over the full day; and Readings of the flowmeter were obtained at the start and end of each sampling day. **Leachate:** The ponds were sampled using a 'scoop', whereas the Balance Tank samples are directly collected from the tap, and the Eastern Arm Collection well is sampled using a 'bailer'.
Analytes	Samples were subject to laboratory analysis for the following: **Table 5-2: Trade Wastewater and Leachate Parameters** **Trade Wastewater**: EC; Ammonia-N **Leachate (CW-East, Balance Tank and Pond P1 and S1)**: TDS, TSS

Activity	Description		
	Biological Oxygen Demand (BOD)	TSS	pH
	TDS	EC	Ammonia-N
	pH	Temperature	Temperature
	Discrete samples were tested for pH, EC and temperature using a calibrated water quality meter at the start and finish of each day.		

[1]As a result, trade wastewater was sampled between 20 and 32 days intervals.

5.2 Performance Criteria

The performance criteria for trade wastewater discharged from the facility to the sewer is provided in the table below:

Table 5-3: Trade Wastewater Performance Criteria

Acceptance Standard	Performance Criteria	Guidance Document
Volume Discharged	605 kL/day	Sydney Water, 2017
Concentrations	Start and finish: pH 7-10 Ammonia-N: 100 mg/L TSS: 600 mg/L TDS: 10,000 mg/L Temperature: <38°C	
Maximum Daily Mass	Ammonia: 36 mg/L TSS: 150 mg/L TDS: 2,500 mg/L BOD: 80 mg/L	
Long-term Average Daily Mass	Ammonia: 3.98 mg/L TSS: 19.5 mg/L TDS: 683.1 mg/L BOD: 7.2 mg/L	

Section 4 O7.2 of EPL 5862 states that the "*licensee must maintain a leachate management system to collect and direct all leachate to a point for treatment and disposal to sewer*". The leachate is treated at the facility and is discharged as Trade Wastewater.

The performance criteria for leachate contained at the facility is provided in the table below:

Table 5-4: Leachate Performance Criteria

Acceptance Standard	Performance Criteria	Guidance Document
Leachate	No discharge of leachate to waters under dry weather conditions (<10 mm of rainfall in 24 hours) or stormwater events of less than 1:25 year, 24 hour recurrence interval (<371.5 mm rainfall in 24 hours).	Section 3 L1.3 of EPL 5862

Note: Discharge of leachate from the pond caused by a 1:25 year, 24 hour recurrence interval storm event or greater does not constitute a breach of EPL 5862.

Consistent with the surface water monitoring performance criteria, Section 7.4 of the LEMP (Golder 2014) for the facility states that all leachate results are to be assessed against the relevant ANZECC, 2000 guidelines, specifically:

- ANZECC, 2000, FW 95%.

Note: Following the update of the LEMP, the ANZAST, 2018 Fresh Water (95%) guidelines and/or other relevant trigger values specified in the document will be adopted during future monitoring events.

5.3 Results

5.3.1 Trade Wastewater Discharged

The full tabulated trade wastewater results for the 2018-2019 annual reporting period are provided in Appendix C.

The volumes discharged and the analyte concentrations, including maximum daily mass and long-term average daily mass concentrations, were all reported below the trigger values specified in the performance criteria, with pH also reported within the recommended range. The maximum and minimum concentrations reported were as follows:

Table 5-5: Trade Wastewater Discharged

Analyte	Minimum	Maximum	Performance Criteria
Volume Discharged	6 kL (28/08/2018)	131 kL (16/03/2018)	605 kL/day
pH start	7.9 (16/03/2018)	9.2 (14/11/2018)	pH 7-10
pH finish	8 (16/03/2018)	9 (14/11/2018)	
Ammonia-N Concentrations	0.1 mg/L (numerous occasions)	24.6 mg/L (28/08/2018)	100 mg/L
Ammonia Maximum Daily Mass	0.0 mg/L (numerous occasions)	0.15 mg/L (28/08/2018)	Maximum Daily Mass: 36 kg/day

Analyte	Minimum	Maximum	Performance Criteria
			Long-term Average: 3.98 kg/day
TSS	16 mg/L (19/02/2019)	239 mg/L (27/07/2018)	600 mg/L
TDS	5,180 mg/L (10/04/2018)	7,670 mg/L (12/09/2018)	10,000 mg/L
Temperature	10°C (27/07/2018)	29°C (29/01/2019)	<38°C

5.3.2 Leachate

The full tabulated trade wastewater results for the 2018-2019 annual reporting period are provided in Appendix D, with a summary of results presented in the following sections.

5.3.2.1 Inorganics

No trigger values were adopted for TDS, TSS, pH and temperature. The recorded minimum and maximum concentrations during the annual period are provided in the table below:

Table 5-6: Leachate Concentrations

Location	Analyte	Minimum Concentration	Maximum Concentration
Balance Tank	TDS mg/L	8.9 (2/07/2018)	7,940 (3/09/2018)
	TSS mg/L	19 (1/03/2019)	385 (25/06/2018)
	pH units	7.3 (30/07/2018)	9 (16/07/2018 and 23/07/2018)
	Temperature °C	11.2 (23/07/2018)	38.2 (1/03/2019)
Eastern Arm Collection Well	TDS mg/L	8.1 (2/07/2018)	10,200 (26/11/2018)
	TSS mg/L	<5 (4/02/2019 and 1/03/2019)	925 (30/07/2018)
	pH units	7.9 (11/02/2019)	8.4 (19/06/2018 and 16/07/2018)
	Temperature °C	24.8 (1/03/2019)	38.5 (18/02/2019)
Pond P1	TDS mg/L	7.7 (2/07/2018)	7,160 (4/10/2018)
	TSS mg/L	47 (25/02/2019 and 1/03/2019)	508 (19/06/2018)
	pH units	5 (29/10/2018)	7.8 (26/03/2018)
	Temperature °C	11.9 (19/06/2018)	27.7 (4/02/2019)
Pond S1	TDS mg/L	3,440 (26/11/2018)	5,580 (5/03/2018)
	TSS mg/L	8 (7/01/2019)	108 (26/11/2018)

Location	Analyte	Minimum Concentration	Maximum Concentration
	pH units	4 (3/04/2018)	7.4 (3/12/2018)
	Temperature °C	20.3 (19/11/2018)	29.4 (11/02/2019)

Note: Pond S1 was dry on 19/6/2018 and also between 2/07/2018 and 29/10/2018; therefore, this pond was unable to be sampled at these times.

5.3.2.2 Ammonia-N

The following Ammonia-N exceedances were reported:

Table 5-7: Leachate Ammonia-N Exceedances

Location	Sampling Event	Minimum Concentration Exceeding Assessment Criteria	Maximum Concentration	Performance Criteria – ANZECC, 2000 FW 95%
Balance Tank	7/5/2018,14/05/2018, 22/05/2018, 25/06/2018, 22/05/2018, 6/08/2018, 27/08/2018, 8/10/2018, 15/10/2018, 12/11/2018, 10/12/2018 and 17/12/2018	1.5 mg/L (06/08/2018 and 15/10/2018)	46.3 mg/L (22/05/2018)	0.9 mg/L
Eastern Arm Collection Well	All events	1,460 mg/L (14/05/2018)	1,920 mg/L (27/08/2018)	
Pond Primary (P1)	All events	48.3 mg/L (22/05/2018)	235 (27/08/2018 and 3/09/2018)	
Pond Secondary (S1)	All events	2 mg/L (25/06/2018)	132 mg/L (5/03/2018)	

5.4 Conformances

Based on the reported results pertaining to trade wastewater discharged, the facility was in conformance for the 2018-2019 annual reporting period.

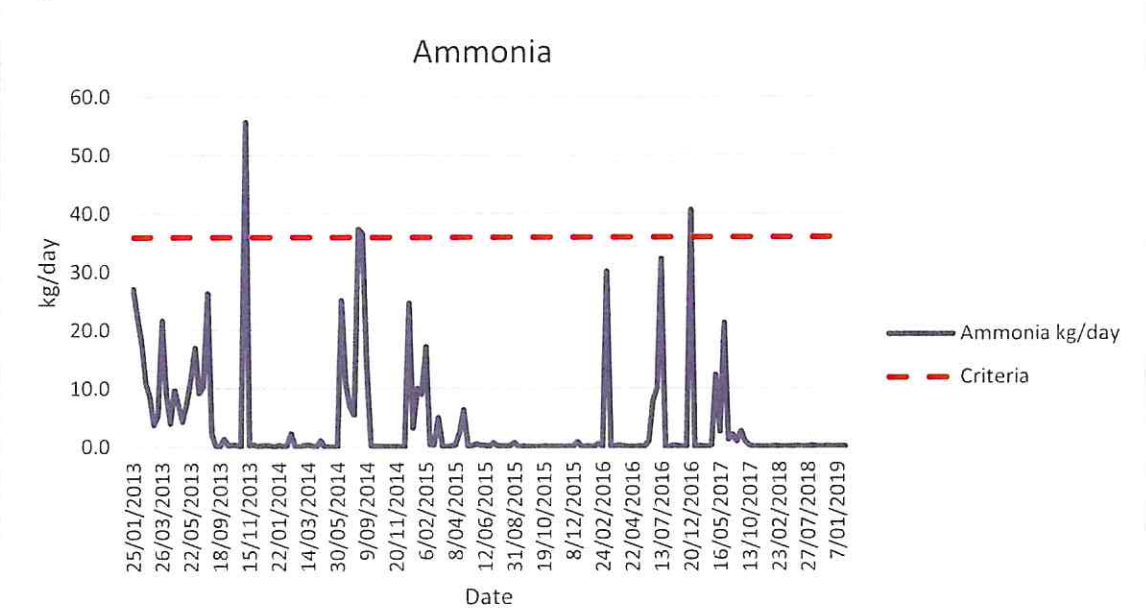
A number of ammonia-N exceedances were reported in the leachate samples; however, this does not impact the facility's successful operation, as this leachate is treated and discharged as trade wastewater, with the trade wastewater reporting all analyte concentrations, including ammonia-N below the performance criteria.

5.5 Monitoring Trends

5.5.1 Ammonia

As shown in the graph below, ammonia concentrations in trade wastewater have been subject to fluctuations, however, they have generally been reported below the performance criteria. Ammonia did exceed the performance criteria on several occasions, with the last one occurring in December 2016. Improvement to the leachate treatment facility has resulted in reduced ammonia concentrations detected since 2017.

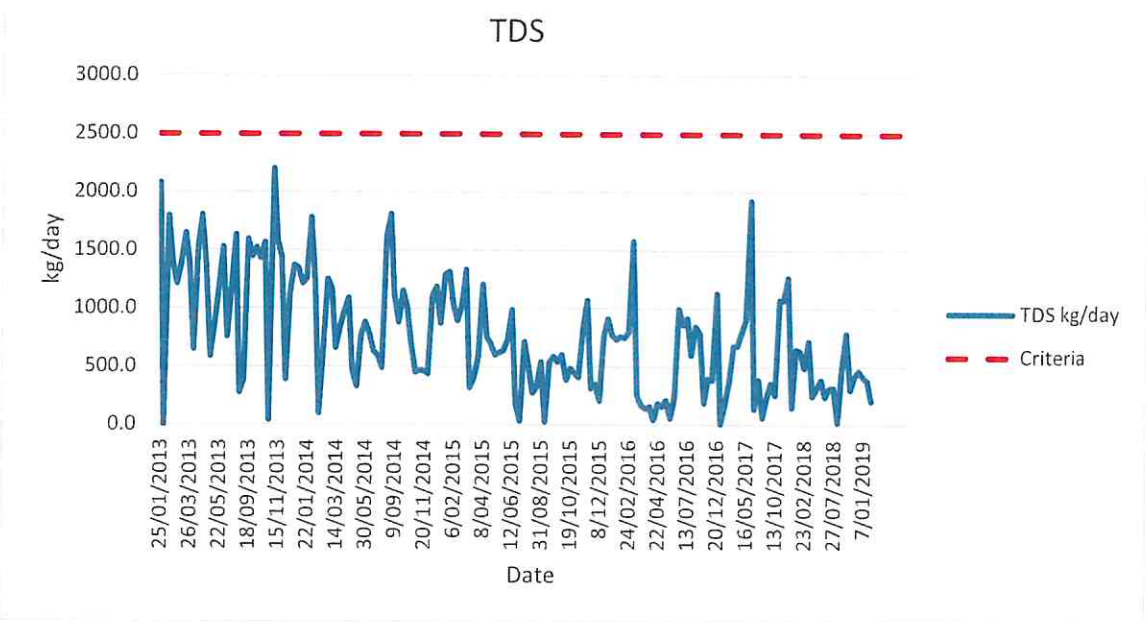
Graph 11: Ammonia



5.5.2 TDS

As shown in the graph below, TDS concentrations in trade wastewater have been subject to fluctuations. Nonetheless, concentrations have been reported below the performance criteria, with an overall decreasing trend noted.

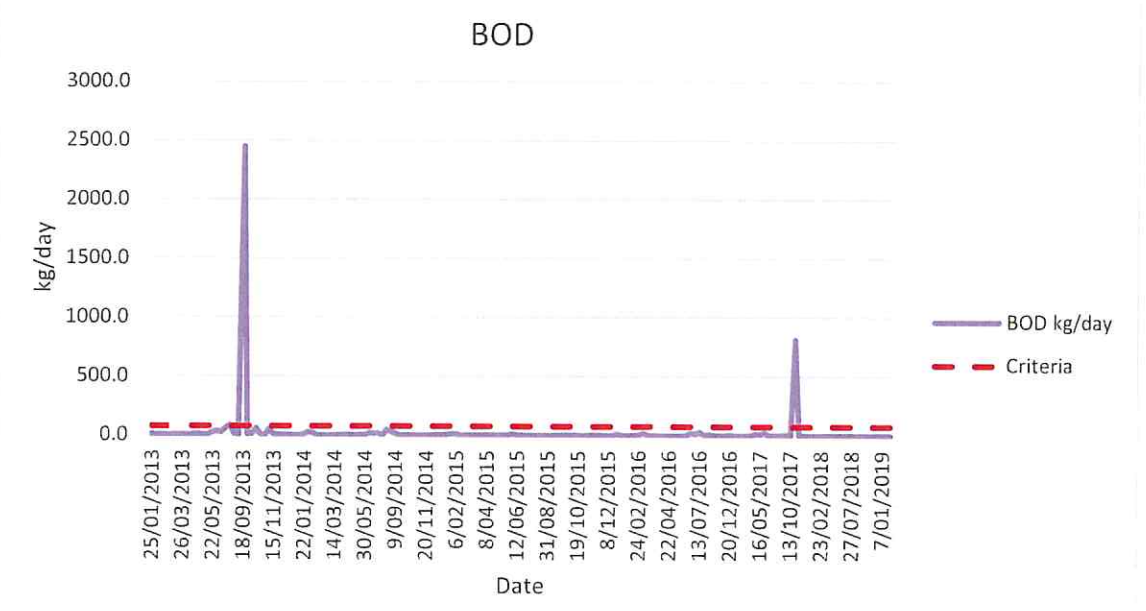
Graph 12: TDS



5.5.3 BOD

As shown in the graph below, BOD concentrations in trade wastewater have generally been stable and below the performance criteria, excluding two occasions, where BOD concentrations spiked (2013 and 2017). Improvement to the leachate treatment facility has resulted in reduced BOD concentrations detected since 2017.

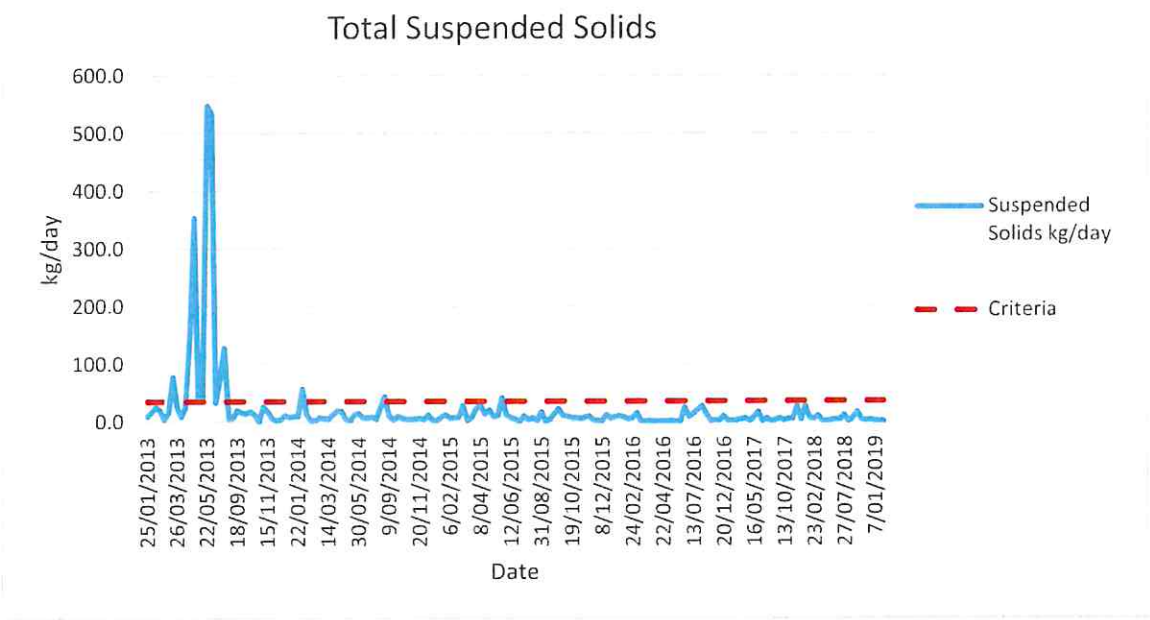
Graph 13: BOD



5.5.4 TSS

As shown in the graph below, TSS concentrations in trade wastewater have generally been stable and below the performance criteria. This is with the exception of several occasions in 2013 and two discrete occasion in 2014 and 2015, where the performance criteria was exceeded.

Graph 14: TSS



5.6 EA Predictions

There were no EA predictions pertaining to trade wastewater discharged. At the time of the EA, the facility had a trade waste agreement with Sydney Water to treat and discharged 250 kL/day. This has since increased to 605 kL/day under the new agreement.

Water balance modelling was undertaken (Golder, 2014) to assess the overall volume of leachate generated by the facility. The leachate ponds have a holding capacity of approximately 18,000 kL, and therefore, would have sufficient capacity to store leachate generated during Stage 1 and 3 under average rainfall conditions. The EA predictions were confirmed during this annual period, where there was sufficient holding capacity for leachate in the ponds.

6 Waste – General

Waste screening and monitoring is required in order to satisfy Project Approval No. 11_0094 Schedule 4, conditions pertaining to 'Waste'. The findings for the 2018-2019 annual reporting period are provided in the sections below.

6.1 Overview

Waste screening and monitoring was undertaken by the Council for the 2018-2019 annual period in accordance with EPL 5862 and Project Approval No. 11_0094. A summary of the requirements are detailed in the table below:

Table 6-1: General Waste

Activity	Description
Purpose	To ensure that the facility only accepts wastes that are authorised for receipt as per EPL 5262.
Frequency	**Random vehicle audits:** Daily. **Screening of waste:** Continuous. **Screening when truck tipping at the tip face or tipping at transfer station:** Continuous.
Location	Weighbridge and transfer station tipping face.
Methodology	• Signs are present at the facility clearly stating the material accepted. The customer declares at the weighbridge the type of waste being disposed. Where the weighbridge operator is suspicious of the waste load, an inspection of the load is conducted; • Inspections via above load CCTV at the weighbridge; • Industrial loads require an application to be submitted with the waste loads – which is then reviewed by the weighbridge operator; and • Visual inspection of small vehicle loads at the tipping face of the transfer station.

6.2 Performance Criteria

The performance criteria for waste received at the facility is provided in the following table:

Table 6-2: Waste Performance Criteria

Description	Performance Criteria	Guidance Document
Rejected Loads	Quantity of unacceptable waste types rejected.	LEMP (Golder, 2014).
	Number of detection reports of any waste rejected.	
	Number of incidences whereby unacceptable waste was discovered at the tipping face.	
	Monitoring data indicating consistent occurrences of unacceptable waste being detected.	
Tyres	No disposal of tyres <1.2 m in diameter.	EPL 5862.
	No stockpiling of more than 50 tonnes at any one time.	
General solid waste (non-putrescible)	No more than 180,000 tonnes per annum.	Schedule 3, Condition 5 Project Approval No. 11_0094.
General solid waste (putrescible)		
Asbestos	*Not currently accepted at the facility.*	

6.3 Results

During the annual period, only suitable waste steams were accepted at the facility, with an inbound total of 137,963.47 tonnes of material received. This is less than the maximum allowable performance criteria limit (180,000 tonnes per annum (tpa)).

6.3.1 Rejected Loads

There was a total of 2,106 loads rejected during the 2018-2019 annual period.

6.3.2 Tyres

A total of 272 tyres were received during the annual period. The tyres were temporarily stored at the facility in accordance with EPL 5268, following which they were collected and taken offsite for recycling by Tyrecycle.

6.3.3 Asbestos

No asbestos containing material (ACM) was accepted at the facility during the 2018-2019 annual period.

6.3.4 Other Inbound and Outbound Waste

A summary of the inbound and outbound waste streams for the 2018-2019 annual period is provided in the tables below:

Table 6-3: Inbound Waste

Waste Stream Description	Inbound (tonnes)
Mixed Waste – Clean Up Australia Day	8.26
Dead Animals	21.24
General Waste	54,479.27
Commercial General Waste	25,105.08
Weighbridge Failure – Small Domestic Waste	0.12
Total	**79,613.97**
Specific items (tyres and mattresses)	1,952 (items)
Recyclables (kerbside tyres and E-waste)	2,335.38 (items)

Table 6-4: Outbound Waste

Waste Stream	Outbound (tonnes)
External Sources[1]	2,314.54
Outbound products[2]	6,929.80
Total	**9,244.34 tonnes**

[1]*Includes: computers/televisions, CRC, general recyclables, metal and motor oil.*
[2]*Includes: clay, computer/televisions, gravel/aggregate, green waste, mattresses, 'other', rejected material, material from the revolve/recycle area, tyres and VENM.*

6.4 Conformances

In relation to waste, the facility operated in conformance during the 2018-2019 annual reporting period.

6.5 Monitoring Trends

The total waste stream volumes received between 2013 and 2019 have generally remained consistent, with a slight overall decreasing trend observed in the total waste stream volumes. This trend is presented in the graph below:

Graph 15: Inbound Waste Trends

6.6 EA Predictions

The EA predictions were made based on previous weighbridge data records. In the EA predictions, it was reported that the waste volume received at the facility between the period 2008 and 2012 would range between approximately 120,000-150,000 tpa. It was predicted that the volume of waste accepted at the facility would not increase, and the waste stream volume for the 2018-2019 annual period was consistent with this EA prediction. Waste volumes are decreasing, resultant of more recycling and diversion from landfill.

7 Air Quality Monitoring – Landfill Gases

Landfill gas monitoring was completed in order to satisfy Project Approval No. 11_0094 conditions in Schedule 4, pertaining to 'Air Quality'. The findings for the 2018-2019 annual reporting period are provided in the sections below.

7.1 Overview

Surface gas, subsurface gas and gas accumulation into buildings monitoring was undertaken by ALS Environmental in accordance with the *NSW EPA Environmental Guidelines: Solid waste landfills (second edition) 2016 (NSW EPA, 2016)*. The monitoring locations are shown in Figure 6. A summary of the monitoring requirements for the facility are detailed in the table below:

Table 7-1: Landfill Gas Monitoring

Activity	Description
Surface Monitoring	
Purpose	Demonstrate that the cover material and extraction system is controlling the emissions of landfill gas.
Frequency	Monthly in accordance with EPL 5862.
Locations	• Transects 1-11[1]; • Former landfill cell located to the north-west of the current active cell. Transects: A, C, D, E, F, G, H and I; • Recycle/Revolve East and West; and • Reddalls Road and Farmborough Road fence lines.
Methodology	Monitoring was undertaken using a calibrated *Inspectra Laser Gas Detector*. Methane concentrations were recorded at 5 cm above the ground surface in areas containing intermediate or final cover. The monitoring was undertaken at 25 m spaced out transects on calm days, where wind speeds were <10 km/hr.
Subsurface Monitoring	
Purpose	Assess the presence of methane along the perimeter of the landfill cell and the potential for offsite migration.
Frequency	Monthly in accordance with EPL 5862.
Locations	12 landfill gas monitoring wells, including: EPA Point 21 (LFG MW1) to Point 32 (LFG MW12) in accordance with EPL 5862.
Methodology	Monitoring was undertaken using a calibrated *Inspectra Laser Gas Detector*.
Gas Accumulation	
Purpose	Demonstrate that methane is not accumulating in enclosed spaces.
Frequency	Monthly in accordance with EPL 5862.
Locations	• Weighbridge; • Glengarry Cottage (Administrative building); and

Activity	Description
	• Solid Waste to Energy Recycling Facility (SWERF)[2].
Methodology	Monitoring was undertaken using a calibrated *Inspectra Laser Gas Detector*.

[1] There was no access to transects 4 and 11. In addition, several other transects were unable to be monitored during one or more occasions due to access constraints. Old infrastructure (methane cages) were present at several transect locations, and therefore were also subject to surface monitoring.
[2]SWERF was not monitored on several occasions due to being locked. This was under management by a recycling contractor at the time, which undertook their own monitoring.

7.2 Performance Criteria

The performance criteria adopted for the 2018-2019 annual reporting period for landfill gases is provided in the table below:

Table 7-2: Landfill Gas Criteria

Details	Corrective Action Criteria	Mandatory Reporting Requirement	Guidance Document
Surface Gas	Methane: 500 parts per million (ppm)	Yes	NSW EPA, 2016
Subsurface	Methane: 1.0% volume/volume (v/v)	Yes	
	Carbon Dioxide: 1.5% v/v, above established background levels.	No	
Gas Accumulation	Methane: 1% v/v	Yes	

7.3 Results

The landfill gas monitoring results for the 2018-2019 annual reporting period are summarised in the following sections, with a copy of the results provided in Appendix E.

7.3.1 Surface

Surface gas results were all reported below the 500 ppm threshold. The highest reported methane concentration was 36.9 ppm, which was measured at Transect 10 on 18/07/2018.

7.3.2 Subsurface

Subsurface gas results for methane were all reported below the 1% v/v threshold. The reported concentrations ranged between 0.0 % v/v and 0.1% v/v at all locations. Three EPA Points, 30, 31 and 32, were inaccessible during both the June 2018 and July 2018 monitoring events due to construction works occurring at that time.

7.3.3 Gas Accumulation

Gas accumulation results were all reported below the 1% v/v threshold. The highest reported concentration was at the weighbridge (0.00044% v/v) on 11/04/2018.

7.4 Conformances

In reference to the mandatory requirements (methane monitoring), the facility operated in conformance for the 2018-2019 annual reporting period.

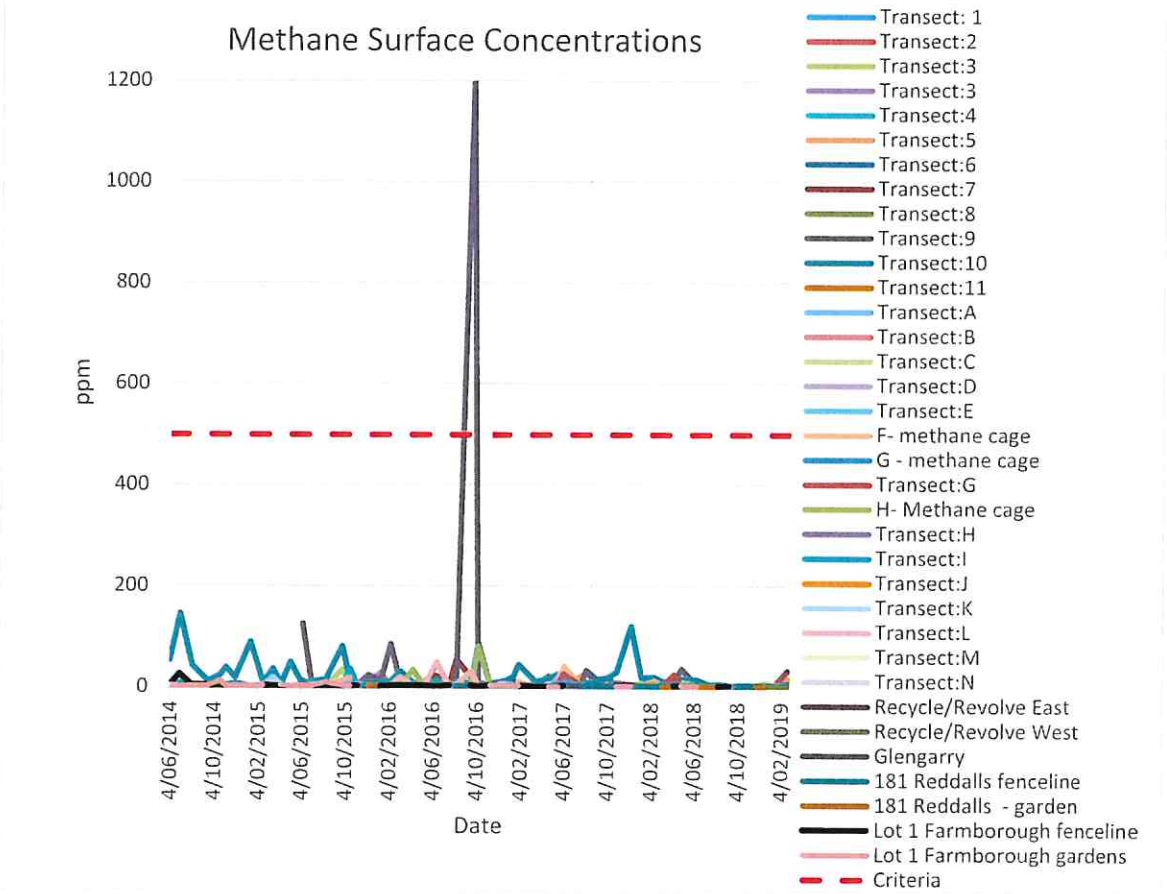
7.5 Monitoring Trends

During the monitoring period 2014-2019, it appears that the stabilised methane readings across the surface, subsurface and gas accumulation into buildings has remained relatively stable, with no exceedances of the performance criteria reported. This is with the exception of elevated concentrations of methane at EPA Point 32 during a single monitoring event on 13/08/2015 and Transect Point 9 on 29/09/2016. Graphs showing the landfill gas trends are presented below, and in Appendix E.

7.5.1 Surface Methane

As shown in the following graph, the surface methane concentrations have generally remained low (below 150 ppm) and stable, subject to minor fluctuations. A single exceedance in the performance criteria was however noted at Transect Point 9 on 29/09/2016.

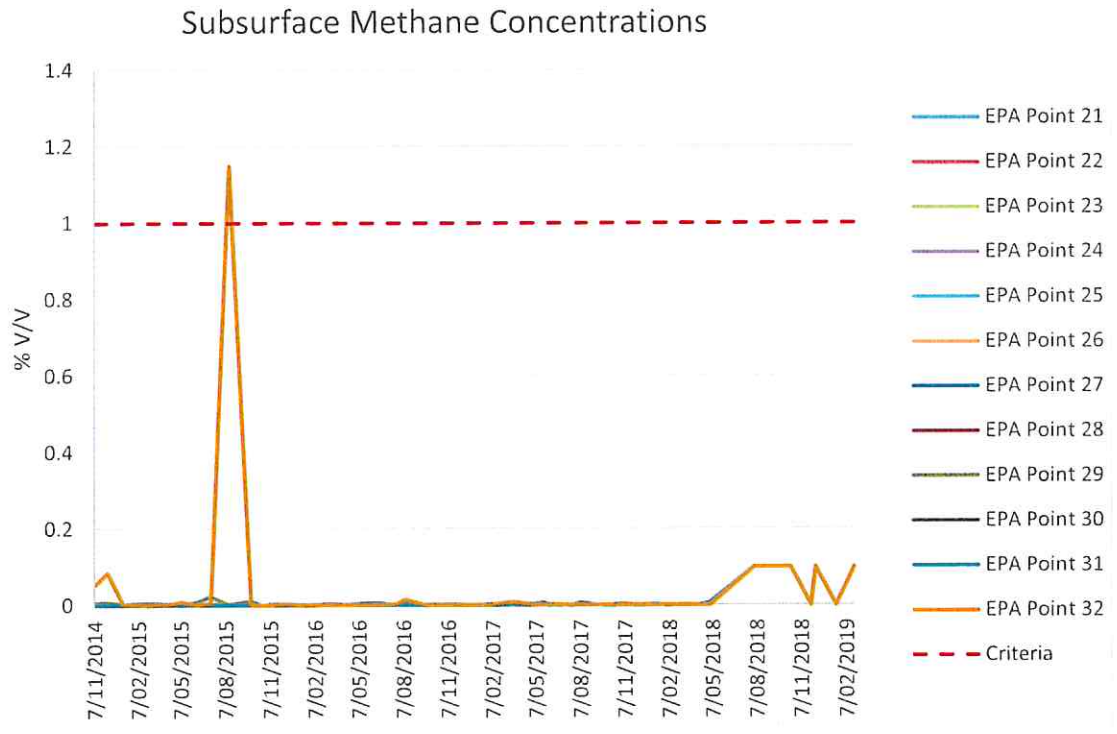
Graph 16: Methane Surface Concentrations



7.5.2 Subsurface Methane

As shown in the following graph, the subsurface methane concentrations have generally remained low and stable (<0.1 % v/v). A single exceedance in the performance criteria was noted at EPA Point 32 during a single monitoring event on 13/08/2015.

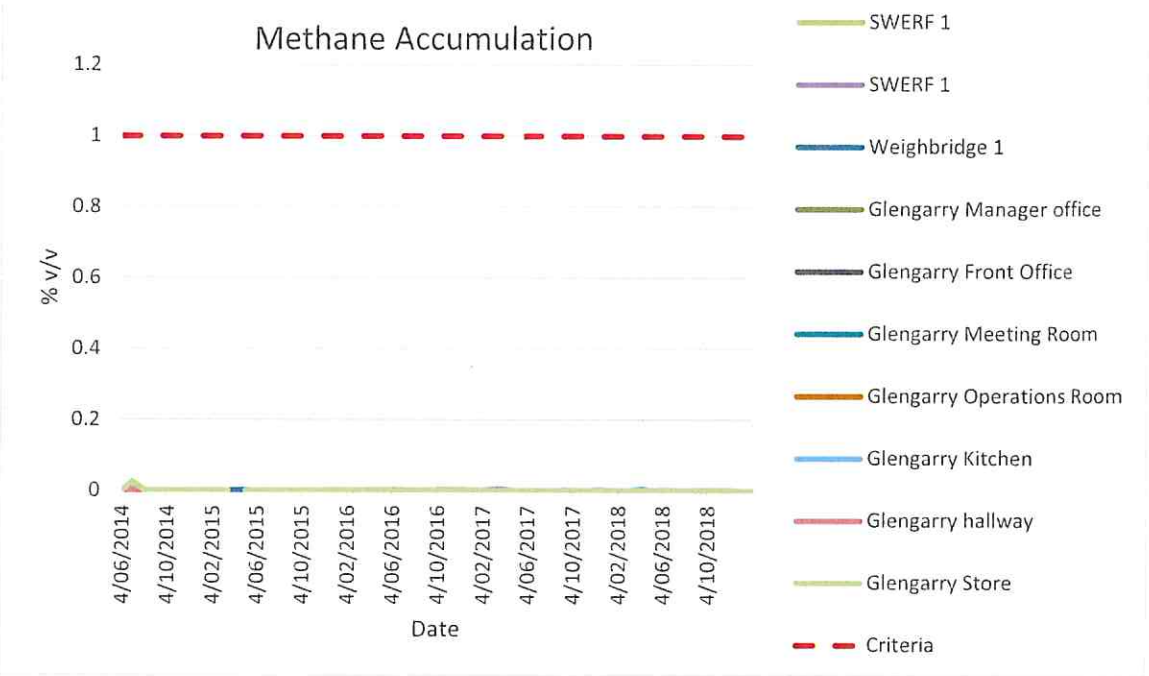
Graph 17: Subsurface Methane Concentrations



7.5.3 Gas Accumulation

As shown in the following graph, the methane concentrations accumulating into buildings have remained low (generally below 0.005% v/v) and stable, with no exceedance in the performance criteria (1% v/v) reported.

Graph 18: Methane Accumulation Concentrations



7.6 EA Prediction

There were no predictions pertaining to concentrations of methane accumulating into buildings, subsurface and near surface emissions.

8 Air Quality Monitoring – Dust

Dust monitoring was completed in order to satisfy Approval No. 11_0094 conditions in Schedule 4, pertaining to 'Air Quality'. The findings for the 2018-2019 annual reporting period are provided in the sections below.

8.1 Overview

Dust monitoring was undertaken on a continuous basis using dust deposition gauges as detailed in the table below, with sampling locations presented in Figure 6.

Table 8-1: Dust Monitoring

Activity	Description
Purpose	Measure respirable dust to sensitive receptors.
Frequency	Continual basis with dust deposition gauges (DDG) collected and analysed monthly.
Locations	A total five locations were subjected to monitoring, including DDG1-DDG5 which were placed around the perimeter of the facility, with high-vol samplers set up at two of these locations (DDG1 – Whytes Gully and DDG2 – Glengarry Cottage).
Methodology	The dust deposition gauges were installed by ALS Environmental in accordance with *Australian Standard (AS) 3580.10.1:2003 Methods for analysis of ambient air, Method 10.1: Determination of particulate matter-Deposited matter-gravimetric method (AS 3580.10.1:2003).* The gauges were placed around the perimeter of the facility's boundaries with bottles swapped out on a monthly basis. Once per month, respirable dust sampling (particulate matter (PM)) was undertaken at two locations utilising a PM_{10} sampler.
Analytes	The laboratory analysis was as follows: **Table 8-2: Dust Analysis schedule**

Dust Deposition Gauges	PM_{10} Sampler
Ash content (g/m^2/month and mg)	Total suspended particulates (TSP)
Combustible matter (g/m^2/month and mg)	PM_{10}
Total insoluble matter (g/m^2/month and mg)	

8.2 Performance Criteria

The dust monitoring performance criteria adopted for the facility is provided in the following table:

Table 8-3: Dust Criteria

Details	Averaging Period	Criteria	Guidance Document
Long-term for Particulate Matter			
TSP	Annual	90µg/m^3	Approval No. 11_0094
PM_{10}	Annual	30µg/m^3	
Short-term for Particulate Matter			
PM_{10}	24 hour	50 µg/m^3	Approval No. 11_0094
Long-term for Deposited Dust			
Deposited dust	Annual	Maximum increase in deposited dust level: 2 g/m^2/month	Approval No. 11_0094
		Maximum total deposited dust level: 4 g/m^2/month	

8.3 Results

The tabulated dust monitoring results are provided in Appendix F.

TSP and PM_{10} concentrations varied on a monthly basis across the monitoring period. The annual average of particulate matter concentrations, for both TSP and PM_{10}, were all below the performance criteria trigger values during the 2018-2019 annual reporting period, with the averages shown in the table below:

Table 8-4: Dust Averages

Location	Rolling Monthly Average TSP (µg/m^3)	Rolling Monthly Average PM_{10} (µg/m^3)	Performance Criteria(µg/m^3)
DDG1 - Whytes Gully	46.6	22.4	TSP: 90
DDG2 – Glengarry Cottage	49.1	24.3	PM_{10} : 30

There were exceedances in the long-term maximum increase and maximum total deposited dust reported at the following DDG locations:

Table 8-5: Dust Exceedances

Dust Deposition Gauge	Date	Maximum Total Insoluble Matter (g/m^2/month)	Increase in Total Insoluble Matter (g/m^2/month)	Criteria
DDG1	10/12/2018-08/01/2019	5.7	Increased by 4.7 g/m^2/month between monitoring period:	Maximum increase in

Dust Deposition Gauge	Date	Maximum Total Insoluble Matter (g/m²/month)	Increase in Total Insoluble Matter (g/m²/month)	Criteria
			08/11/2018 - 10/12/2018 and monitoring period: 10/12/2018-08/01/2019	dust: 2 g/m²/month Maximum Total Dust Level: 4 g/m²/month
DDG4	08/10/2018-08/11/2018	4.6	Increased by 3.6 g/m²/month between monitoring period: 07/09/2018 – 08/10/2018 and monitoring period: 08/10/2018-08/11/2018	
	08/11/2018-10/12/2018	7.8	Increased by 3.2 g/m²/month between monitoring period: 08/10/2018-08/11/2018 and monitoring period: 08/11/2018-10/12/2018	

As stipulated in the 2018-2019 Annual Report prepared for the facility (Cardno, 2019), the results at DDG4 correlate with a dust storm event that occurred in the region in November 2018. However, as no other exceedances were reported during the same period, the exceedances cannot be wholly attributed to this event and may be a consequence of onsite activities. Similarly, the results a DDG1 also cannot be correlated to any other regional event, and therefore the exceedance may be a consequence of onsite activities.

8.4 Conformances

Based on the results for the 2018-2019 annual reporting period, non-conformances were reported at DDG1 over a single month (10/12/2018-08/01/2019) and over a two month period at DDG4 (08/10/2018-10/12/2018). It appears that activities at the facility may have contributed to the exceedances at these locations; they have, however, reduced to normal operational concentrations since.

In addition, DDG1 was not monitored during period 08/01/2019-08/02/2019.

8.5 Monitoring Trends

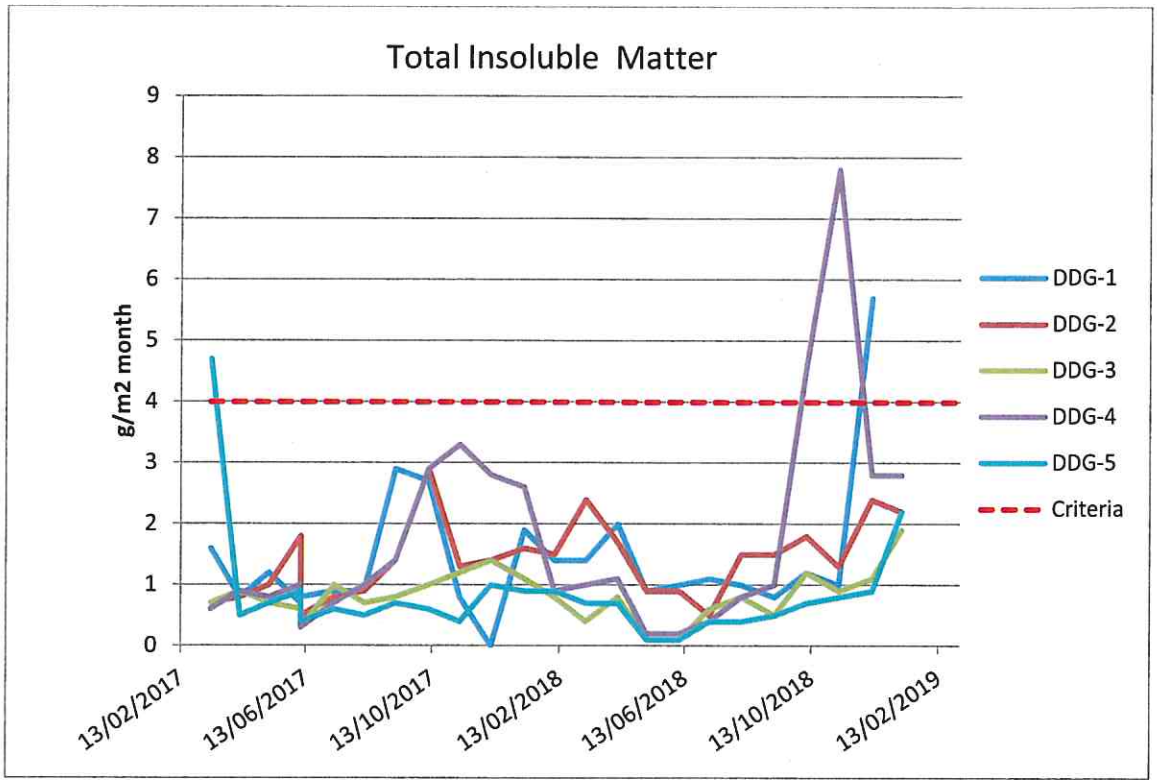
The graphed monitoring trends measured at the DDGs for the period 2017-2019 are provided below.

8.5.1 Total Insoluble Matter

As shown in the graph below, dust concentrations have been subject to fluctuations but were generally below the performance criteria. The dust g/m²/month exceeded the performance criteria

(4g/m^2/month) on several occasions, peaking at DDG5 in 2017, at DDG1 between December 2018-January 2019 and DDG4 towards the end of 2018.

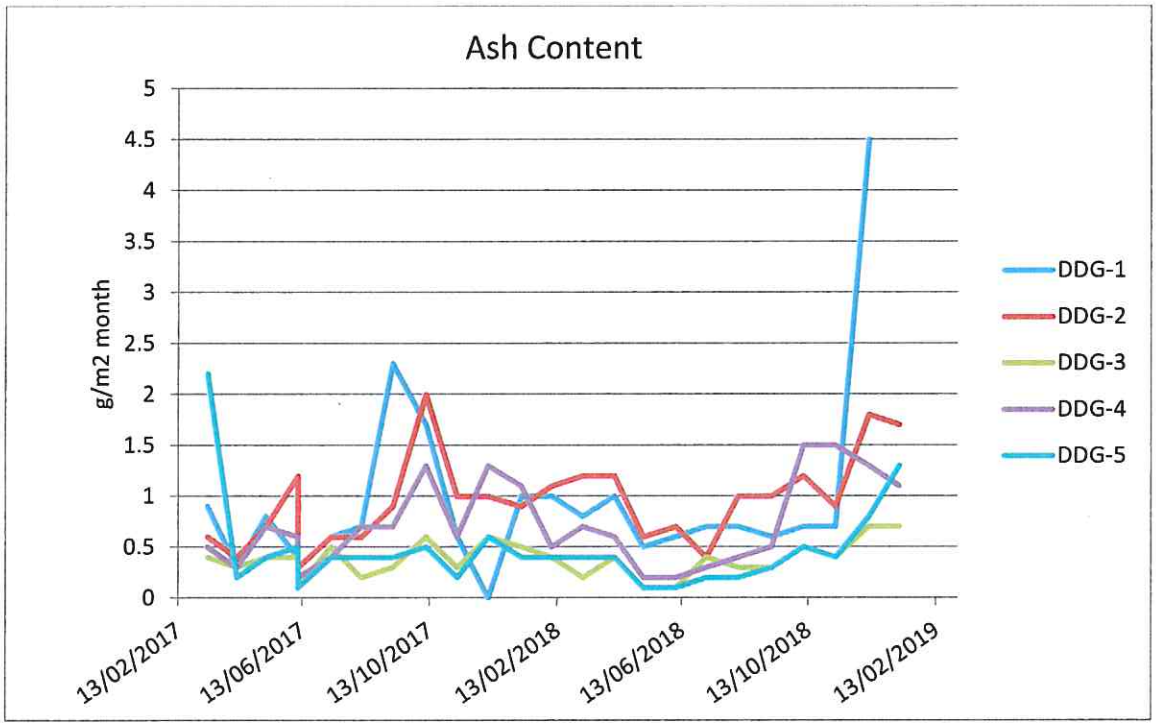
Graph 19: Total Insoluble Matter



8.5.2 Ash Content

There are no trigger values for ash content. As show in the graph below, ash content has been subject to fluctuations, across the monitoring period, with a slight increase noted between mid-2018 and early 2019, while concentrations at DDG1 spiked in December 2018 and January 2019. DDG1 also recorded dust concentrations above the performance criteria during these monitoring periods.

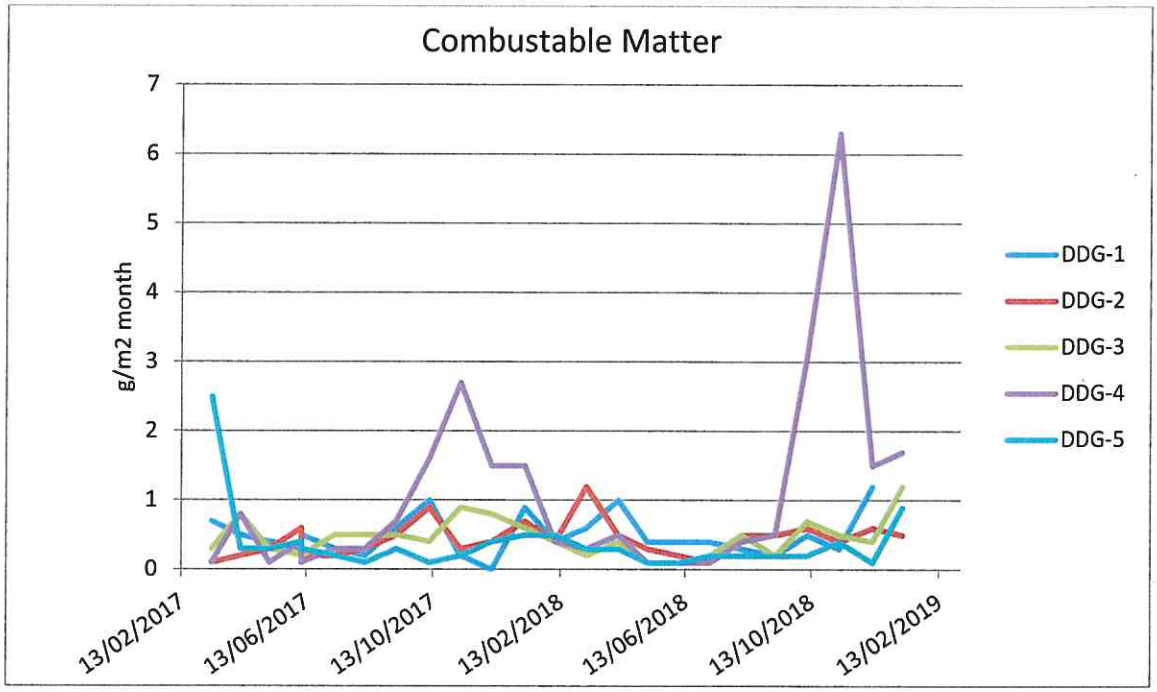
Graph 20: Ash Content



8.5.3 Combustible Matter

There are no trigger values for combustible matter. As show in the graph below, combustible matter has been subject to minor fluctuations across the monitoring period. Two peaks were observed at DDG1 (between September-October 2017 and December 2018-January 2019) and DDG4 (between October-November 2017 and December 2018-January 2019). DDG1 and DDG4 also recorded dust concentrations above the performance criteria during the December 2018-January 2019 monitoring period, whilst DDG-1 recorded an increase in ash content during this time.

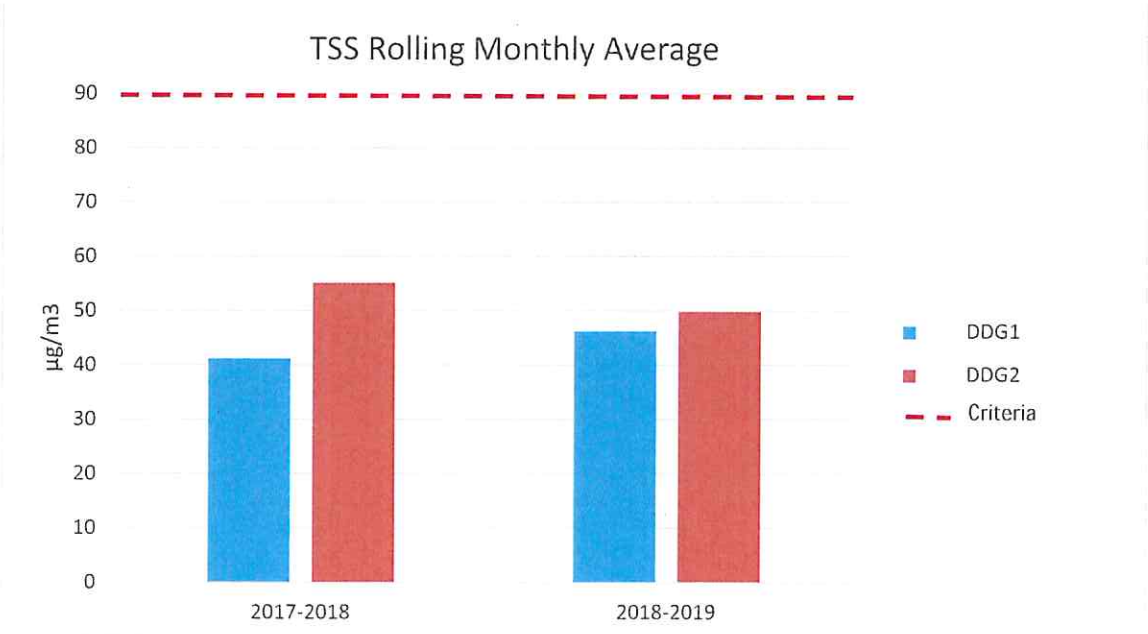
Graph 21: Combustible Matter



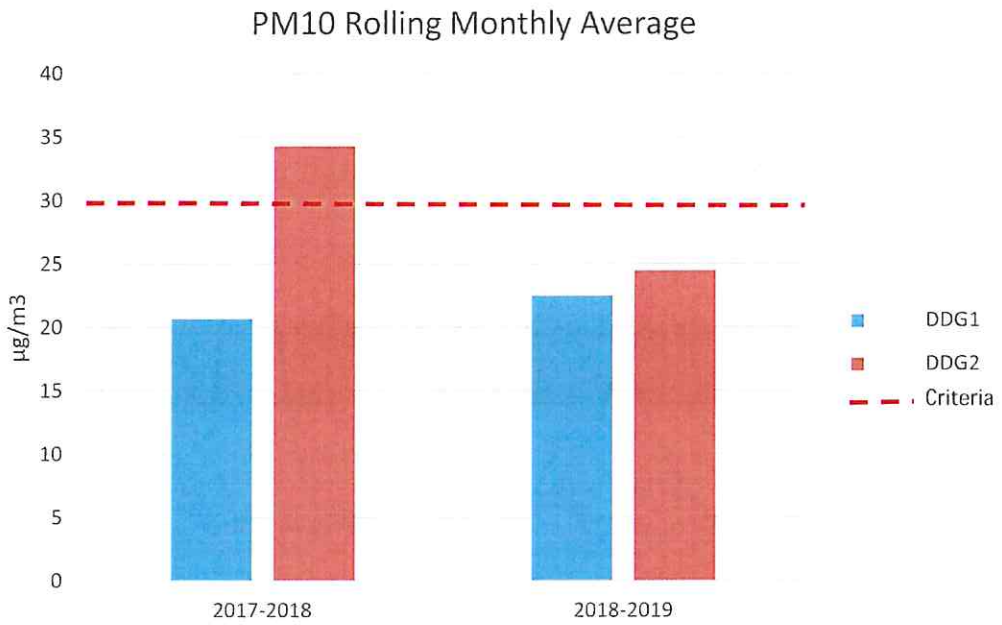
8.5.4 Rolling Monthly TSP PM_{10} Averages

As shown in the following graphs, there has been a slight increase at DDG1 and slight decrease at DDG2 in the rolling monthly average recorded for TSP and PM_{10} between the 2017/2018 and 2018/2019 annual periods.

Graph 22: TSS Rolling Monthly Average



Graph 23: PM10 Rolling Monthly Average



8.6 EA Predictions

The EA predictions made from dispersive modelling undertaken suggested that, should the implementation of appropriate mitigation and management measures be undertaken, there would be compliance with the relevant legislative criteria at all potential offsite residences. During the operational phase of the project, the identified mitigation measures includes restricting the size of the active tipping face and daily cover areas.

With the exception of this annual reporting period, where some exceedances were reported, all other monitoring events were consistent with the EA predictions.

9 Air Quality Monitoring – Odour

Odour management is required at the facility to satisfy Approval No. 11_0094 conditions in Schedule 4, pertaining to 'Air Quality'. The findings for the 2018-2019 annual reporting period are provided in the sections below.

9.1 Overview

Whilst not a mandatory requirement, the Council proactively undertakes inspections, from an odour perspective on an approximate weekly basis around the perimeter of the facility. This is undertaken in order to determine the source of the any potential odour breaches, and where additional active management is required. A copy of the weekly log is provided in Appendix G.

9.2 Performance Criteria

In reference to odour, EPL 5862 stipulates that no offensive odours are to be emitted beyond the boundary of the facility. As such, the performance criteria for potential offensive odour emissions are formal complaints received from the public.

9.3 Results

The Council received a total of 23 formal complaints from the public during the 2018-2019 annual reporting period pertaining to offensive odours noted outside of the facility's boundary. A copy of the Council's complaints summary record is provided in Appendix G.

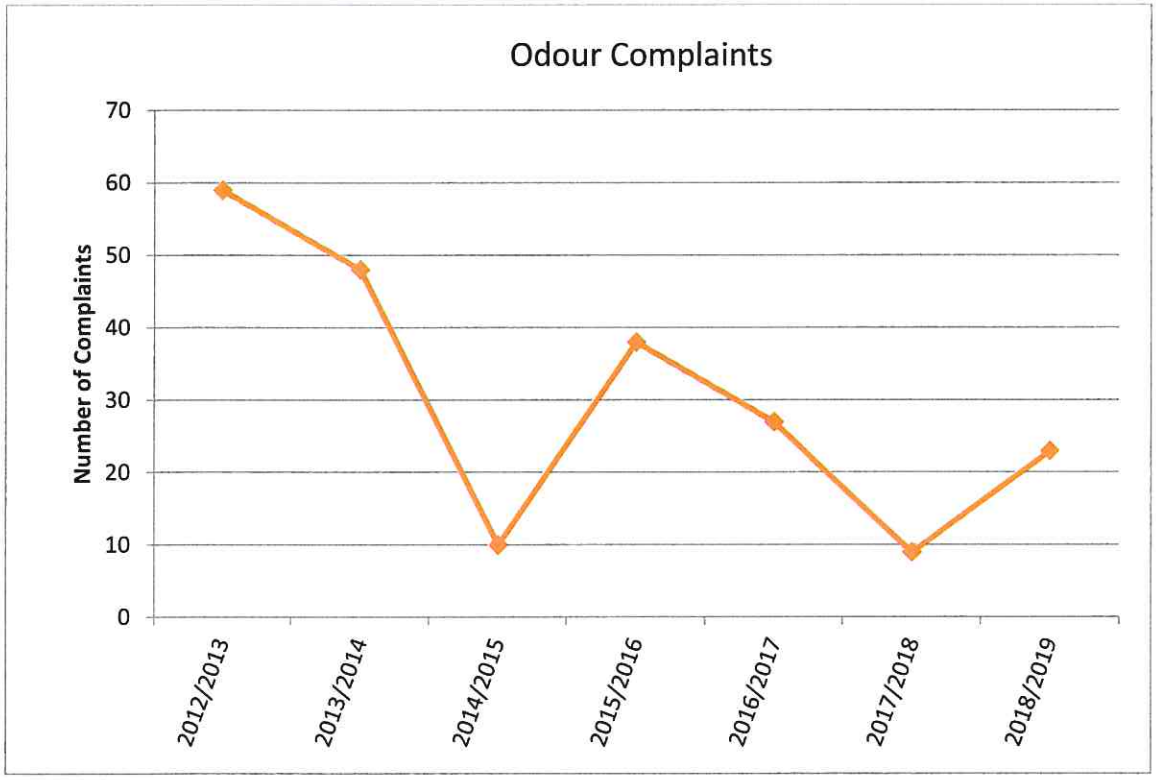
9.4 Conformances

There were several non-conformances pertaining to odour, this was demonstrated by the number of complaints received. This was however appropriately dealt with by the Council, who followed up on each complaint received, and implemented mitigation measures as appropriate.

9.5 Trends

As shown in the graph below, the number of odour complaints received during each annual period has been subject to fluctuations, however, it appears that there is a general decrease in the number of complaints received.

Graph 24: Complaints



9.6 EA Predictions

A CALPUFF odour dispersion modelling undertaken predicted that odour concentrations would not exceed the Office of Environment and Heritage (OEH) assessment criteria at the nearest residences during the 'worst-case' scenario of Stage 1 and Stage 4 of the project. This however does not mean that odour would not necessarily be detected at all, but that odours would not be detected more than 1% of the time.

Quantitative odour assessments are not undertaken. Qualitative odour monitoring is undertaken which is via the number of odour complaints received. Base on the total number of residential (four) odour complaints received during the 2018-2019 annual reporting period, it appears that that, qualitatively speaking, the facility is operating as per EA predictions.

10 Noise Monitoring

Noise monitoring and management is required at the facility to satisfy Approval No. 11_0094 Conditions in Schedule 4, pertaining to 'Noise'.

Noise monitoring was not undertaken during the annual reporting period. Noise monitoring at the facility initially commenced in early March 2019 in accordance with the *NSW Industrial Noise Policy* (2000) and *Whytes Gully New Landfill Cell Noise Management Plan, Golder, 2019* (Golder, 2019). Should any noise complaints be received, additional noise monitoring events will be undertaken. Details pertaining to noise will be included in the subsequent 2019-2020 AEMR.

11 Complaints, Incidences and Community Consultation

11.1 Complaints

During the 2018-2019 annual reporting period, a total of 23 complaints were received. All complaints were pertaining to offensive odour detected offsite, as detailed in Section 9.

11.2 Incidents

A single fire was reported at the transfer station, which occurred at 15:30 on 31/07/2018. The weighbridge was closed immediately and the fire was extinguished by the NSW Rural Fire Service and was reported to the NSW EPA. A copy of the incident report is provided in Appendix H.

11.3 Community Consultation

Community consultation was undertaken between the Council and the local community on two occasions (23/05/2018 and 13/02/2019) during the annual period. The briefing minutes are provided in Appendix I with a summary of the outcome detailed below.

11.3.1 May 2018

No formal meeting was held due to only a single attendee being present. Several items were raised, including odour and a proposed subdivision/development of land within the vicinity of the facility.

11.3.2 February 2019

Issues were raised in relation to odour, particularly on a number of days in January 2019. The Council did discuss a number of proposed improvements, including:

- Two deodoriser trailers in operation;
- Use of cover material each day and at the end of operations in conjunction with the use of large metal landfill lids;
- Proactive weekly inspections in the Farmborough Heights and Unanderra area; and
- Cessation of waste being placed in the top landfill cell as of late January 2019.

Vehicles parking outside of the facility, prior to its opening time was again raised as a concern.

The ongoing issue of plastic bags and windblown litter was discussed, particularly along boundary fences adjoining neighbouring properties. Council acknowledged that this was a challenge onsite and a number of initiatives were underway to improve this.

The Council also advised the community of revegetation works currently underway including weed management at the northern end of the site and tree planting along the Reddalls Road boundary.

12 Compliances and Non-Compliances

The Annual Return stipulated that that facility operated in compliance during the 2018-2019 annual period. A copy of the Annual Return is provided in Appendix J.

In regards to the specific Project Approval No. 11_0094 compliance requirements, it was reported the facility operated in compliance with all conditions, with the exception of the non-compliances detailed below.

12.1 Monitoring

As detailed earlier in the document, there were several non-conformances pertaining to various monitoring aspects reported during the 2018-2019 annual period, these included:

- **Groundwater:**
  - Raised OC/OP pesticides PQLs which may potentially mask exceedances in the adopted assessment criteria; and
  - Metals exceedances (aluminium, copper, manganese and zinc) at several locations. However, based on previous monitoring data, it appears that aluminium and copper appear to be regionally elevated.
- **Dust:**
  - Based on the results for the 2018-2019 annual reporting period, non-conformances were reported at DDG1 over a single month (10/12/2018-08/01/2019) and over a two month period at DDG4 (08/10/2018-10/12/2018). It appears that activities at the facility may have contributed to the exceedances at these locations; they have, however, reduced to normal operational concentrations since; and
  - In addition, DDG1 was not monitored during period 08/01/2019-08/02/2019.
- **Odour** (discussed below in Section 12.3).

Actions: The Council will ensure that suitable PQLs are adopted during future monitoring events. Groundwater quality at Monitoring Point 16 will be reassessed during the next annual period to ensure that the elevated metals concentrations are not increasing. Currently, it appears that elevated manganese and zinc concentrations are reducing.

In relation to dust, the Council will ensure that appropriate dust suppression measures are in place to ensure that it is in compliance during the next annual period.

Timeframe: Ongoing.

12.2 Schedule 4 Condition 9a

"The Proponent shall:

a) implement suitable measures to prevent the unnecessary proliferation of litter both on and off-site, including the installation and maintenance of a mesh fence of not less than 1.8 metres high around the site; and

b) inspect daily and clear the site (and if necessary, surrounding area) of litter on at least a weekly basis".

Non-compliance: There is compliance in relation to the fencing and inspection and picking of litter on a weekly basis. However, it was noted during the community consultation meeting undertaken in February 2019 that windblown plastic bags are still an issue around boundary fences adjoining neighbouring properties.

Actions: The Council will continue to utilise a litter picking crew on a monthly basis to collect any windblown waste along the perimeter of the facility. In addition, the Council has purchased a trailer mounted commercial vacuum unit to assist in the removal of litter.

No landfilling will occur within the northern portion of the facility, with the new landfill cell, located further south within the Site, utilised which is less exposed to prevailing wind directions. As such, the windblown litter will be reduced over the coming annual periods.

Timeframe: Ongoing

12.3 Schedule 4 Condition 23

"The Proponent shall ensure the project does not cause or permit the emission of any offensive odour (as defined by the POEO Act)".

Non-compliance: A total of 23 complaints were received from the public pertaining to offensive odours detected outside of the facility.

Actions: The Council currently undertakes daily inspections around the perimeter of the facility to assess the odour intensity. The facility currently has two trailer mounted deodorises which are used to diffuse odour. The deodorises are operational daily during the facility's opening hours which can be moved around the facility and are used on an as needs basis. Further to this, daily cover is applied to the landfill cell to minimise odour.

Timeframe: Ongoing

12.4 Schedule 4 Condition 31

"The Proponent shall ensure that the noise generated by the operations on site does not exceed the criteria in Table 6 at any private residential receiver".

Non-compliance: Noise monitoring was not undertaken during the annual period.

Actions: The Council has implemented noise monitoring which commenced in March 2019 in accordance Project Approval and the recently prepared Noise Monitoring Plan (Golder, 2019).

Timeframe: Ongoing

12.5 Schedule 4 Condition 36

"The Proponent shall ensure that:

c) the project does not result in any vehicles queuing on the public road network;
d) heavy vehicles and bins associated with the project do not park or stand on local roads or footpaths in the vicinity of the site;
e) all vehicles are wholly contained on site before being required to stop;"

Non-compliance: It was reported during both community consultation briefings that traffic was an issue with vehicles parking outside of the facility, prior to its opening times.

Actions: The Council raised this issue with its Traffic Committee, consequently 'No Stopping' signs have been erected along the roadway outside the facility. In addition, a letter was sent out to commercial customers reminding them not to queue in front of facility prior to its opening (07:30).

Timeframe: Ongoing, continue to implement traffic management measures.

12.6 Schedule 4 Condition 46

"The Proponent shall:
a) Implement suitable measures to minimise the risk of fire on site, including in the landfill area;"

Non-compliance: A single fire occurred during the annual period, which was extinguished by the NSW Rural Fire Service. It was subsequently reported to the NSW EPA.

Actions: Further warden training and ensuring that fire extinguishers are easily accessible at the facility. In addition, an update of the Pollution Incident Response Management Plan was undertaken, based on the assessment of the fire that occurred at the facility, to ensure the future fires can be managed promptly and effectively.

Timeframe: Ongoing.

12.7 Improvements

A number of non-compliances were reported during the previous annual reporting period as listed in the previous AEMR (*Whytes Gully Landfill Annual Review 2013-2018* (Cardno, 2019)). With consideration to the *Modification of Minister's Approval* dated the 29 May 2018 (MOD 2), the following improvements were undertaken by the Council during this annual reporting period to address and rectify the non-compliances.

12.7.1 Soil, Water and Leachate Management Plan

The soil, water and leachate management plan is under review by Golder to incorporate the amendments to Schedule 4 Condition 18. This plan also addresses stormwater management for the facility.

12.7.2 Noise Management Plan

A noise management plan was completed in February 2019 by Golder (*Whytes Gully New Landfill Cell Noise Management Plan, Golder, 2019* (Golder, 2019)) which was submitted for Approval. Staff training by SLR Consultants in noise monitoring using the CEL 632c Sound Level Meter was also completed, following which monthly monitoring commenced based on the plan's recommendations. Details pertaining to the noise monitoring will be detailed in the next AEMR.

12.7.3 Vegetation Management Plan

In October 2017, a vegetation management plan (flora and fauna assessment) was undertaken as part of the submission for MOD 2. This resulted in an amendment to Schedule 4, Condition 49 and updated the previous vegetation management plan which was completed in 2013. A Biodiversity Offset Strategy was included to address impacts of the new works on the Endangered Ecological Community (EEC) which covers a small area within the north-eastern portion of the facility (as detailed in Appendix K).

12.7.4 Greenhouse Gas Management Plan

Expressions of Interest were sought from contractors to develop a waste to energy solution as part of the management of landfill gas at Whyte's Gully. The brief included the development of a Greenhouse Management Plan to address the conditions in Schedule 3, Condition 30. The Council is currently at the contract finalisation stage with the successful contractor to begin implementation in January 2020.

12.7.5 Landfill Environmental Management Plan

The existing LEMP is currently being reviewed and updated for the first time since its inception in 2014. The actions outlined above will form part of this updated LEMP.

13 Recommendations

In relation to the AEMR prepared for Whytes Gully for the 2018-2019 annual period, Talis recommends the following be undertaken/addressed in the subsequent annual period:

- Ensure the actions specified in Section 12, pertaining to the non-compliances, are undertaken;
- Implement the actions stipulated in the updated LEMP (*when available*) in order to satisfy Project Approval No.11_0094;
- Ensure '*ultra-trace*' levels are adopted for OC/OP Pesticides analysis schedule so that the PQLs are lower or at levels consistent with performance criteria;
- Groundwater wells (Monitoring Points 9, 12 and 13) were noted to be dry since 2016/2017. It is recommended that these wells be decommissioned, and new wells installed adjacent to these locations to close data gaps;
- Increase the groundwater analysis suite to include carbonate and bicarbonate as part of the ionic balance suite. This will assist in the creation of groundwater facies 'piper' plots for future monitoring events. This will allow the assessment of groundwater facies across the facility, which is useful in assessing whether leachate is impacting groundwater by observing potential changes in groundwater facies; and
- Surveying the top of casing of the groundwater monitoring well network to Australian Height Datum (AHD) to enable the creation of groundwater contour plans.

Figures: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290,000
295,000
300,000
305,000
6,190,000
6,185,000
6,180,000
LAKE AVON
MOUNT PLEASANT
FAIRY MEADOW
MOUNT OUSLEY
MOUNT KEIRA
KEIRAVILLE
NORTH WOLLONGONG
NAREENA HILLS
MCARTHUR HEIGHTS
MOUNT KEMBLA
MANGERTON
FIGTREE
CONISTON
CORDEAUX HEIGHTS
FARMBOROUGH HEIGHTS
UNANDERRA
PORT KEMBLA NORTH
CRINGILA
PRINCES MOTORWAY
BERKELEY
LAKE HEIGHTS
PORT KEMBLA
BROWNSVILLE
WARRAWONG
KEMBLA WARRA
HORSLEY
DAPTO
PRINCES HIGHWAY
KANAHOOKA
KOONAWARRA
LAKE ILLAWARRA
Data source: Roads: NSW Spatial Services, 2018. Imagery: ESRI, 2019.
LEGEND
Site Boundary
Railway
Primary Road
Major Road
LOCALITY
Sydney
Wollongong
Port Kembla
Nowra
Canberra
0 50 100 150 200 250 km
LOCALITY
Whytes Gully Waste Disposal Facility
Annual Review Report 2018-2019
City of Wollongong
0 0.5 1 1.5 2 2.5 km
Coordinate System: GDA 1994 MGA Zone 56
Projection: Transverse Mercator; Datum: GDA 1994
Scale @ A2 1:60,000
Prepared: F Walker
Date: 11/09/2019
Reviewed: J S-Bingham
Project No: TE19075
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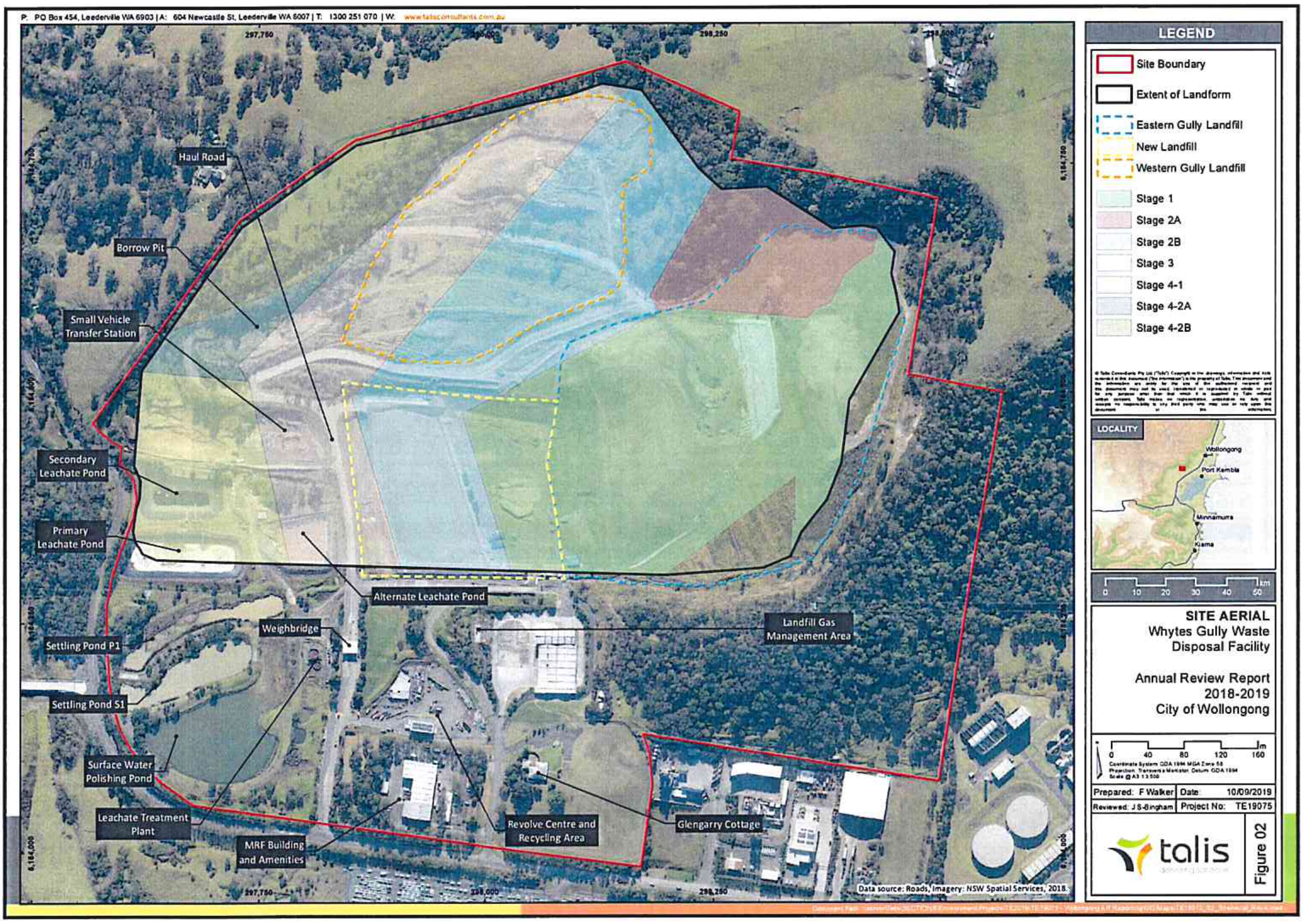
Figure 01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297,750
298,250
Haul Road
Borrow Pit
Small Vehicle Transfer Station
Secondary Leachate Pond
Primary Leachate Pond
Alternate Leachate Pond
Weighbridge
Landfill Gas Management Area
Settling Pond P1
Settling Pond S1
Surface Water Polishing Pond
Leachate Treatment Plant
MRF Building and Amenities
Revolve Centre and Recycling Area
Glengarry Cottage
Data source: Roads, Imagery: NSW Spatial Services, 2018.
LEGEND
Site Boundary
Extent of Landform
Eastern Gully Landfill
New Landfill
Western Gully Landfill
Stage 1
Stage 2A
Stage 2B
Stage 3
Stage 4-1
Stage 4-2A
Stage 4-2B
LOCALITY
Wollongong
Port Kembla
Minnamurra
Kiama
0 10 20 30 40 50 km
SITE AERIAL
Whytes Gully Waste Disposal Facility
Annual Review Report 2018-2019
City of Wollongong
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Prepared: F Walker
Date: 10/09/2019
Reviewed: J S-Bingham
Project No: TE19075
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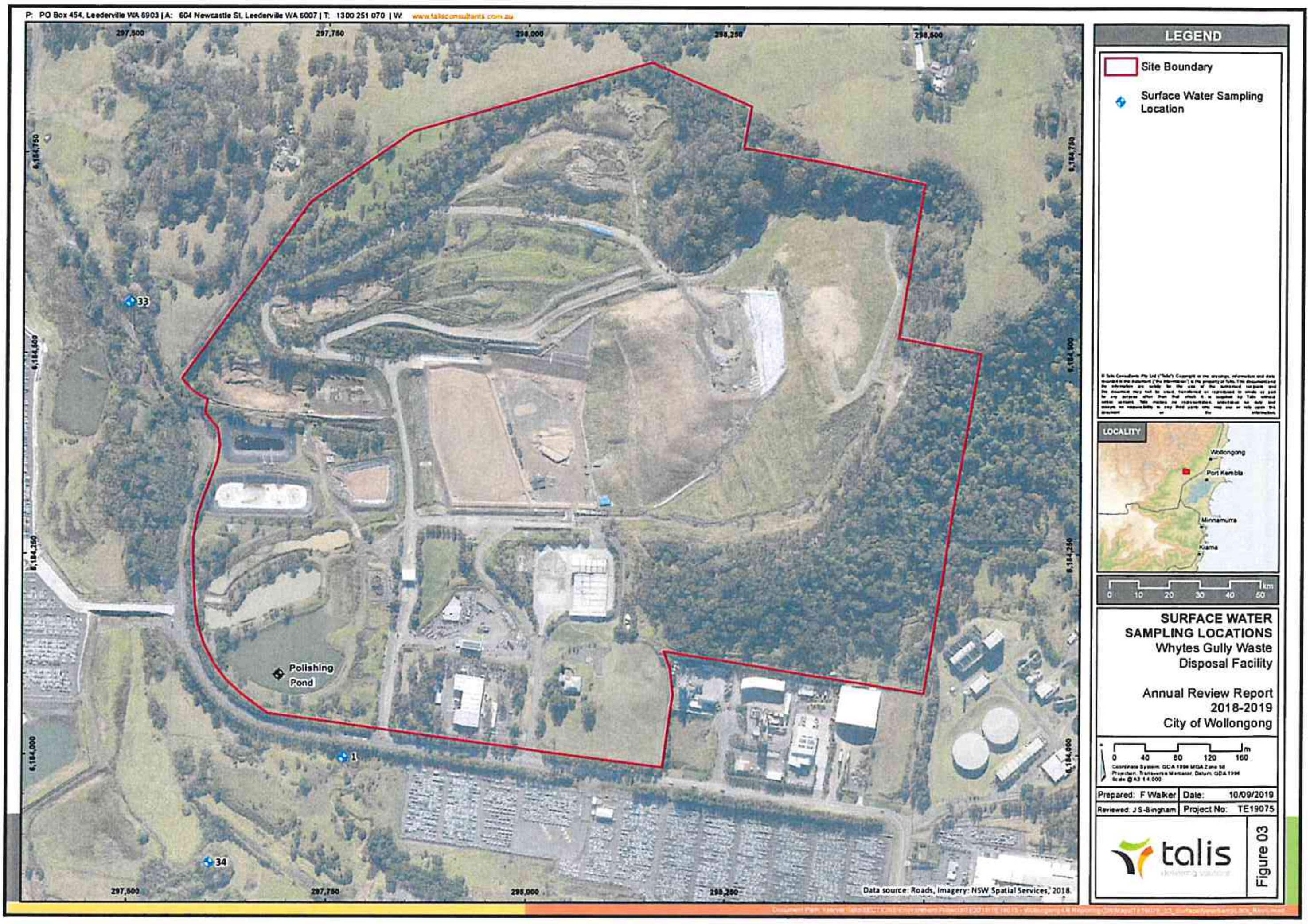
Figure 02


P: PO Box 454, Leederville WA 6903 | A: 604 Newcastle St, Leederville WA 6007 | T: 1300 251 070 | W: www.talisconsultants.com.au
297,500
297,750
298,000
298,250
298,500
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6,184,250
6,184,000
33
1
34
Polishing Pond
Data source: Roads, Imagery: NSW Spatial Services, 2018.
LEGEND
Site Boundary
Surface Water Sampling Location
LOCALITY
Wollongong
Port Kembla
Minnamurra
Kiama
0 10 20 30 40 50 km
SURFACE WATER SAMPLING LOCATIONS
Whytes Gully Waste Disposal Facility
Annual Review Report 2018-2019
City of Wollongong
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Prepared: F Walker
Date: 10/09/2019
Reviewed: J S-Bingham
Project No: TE19075
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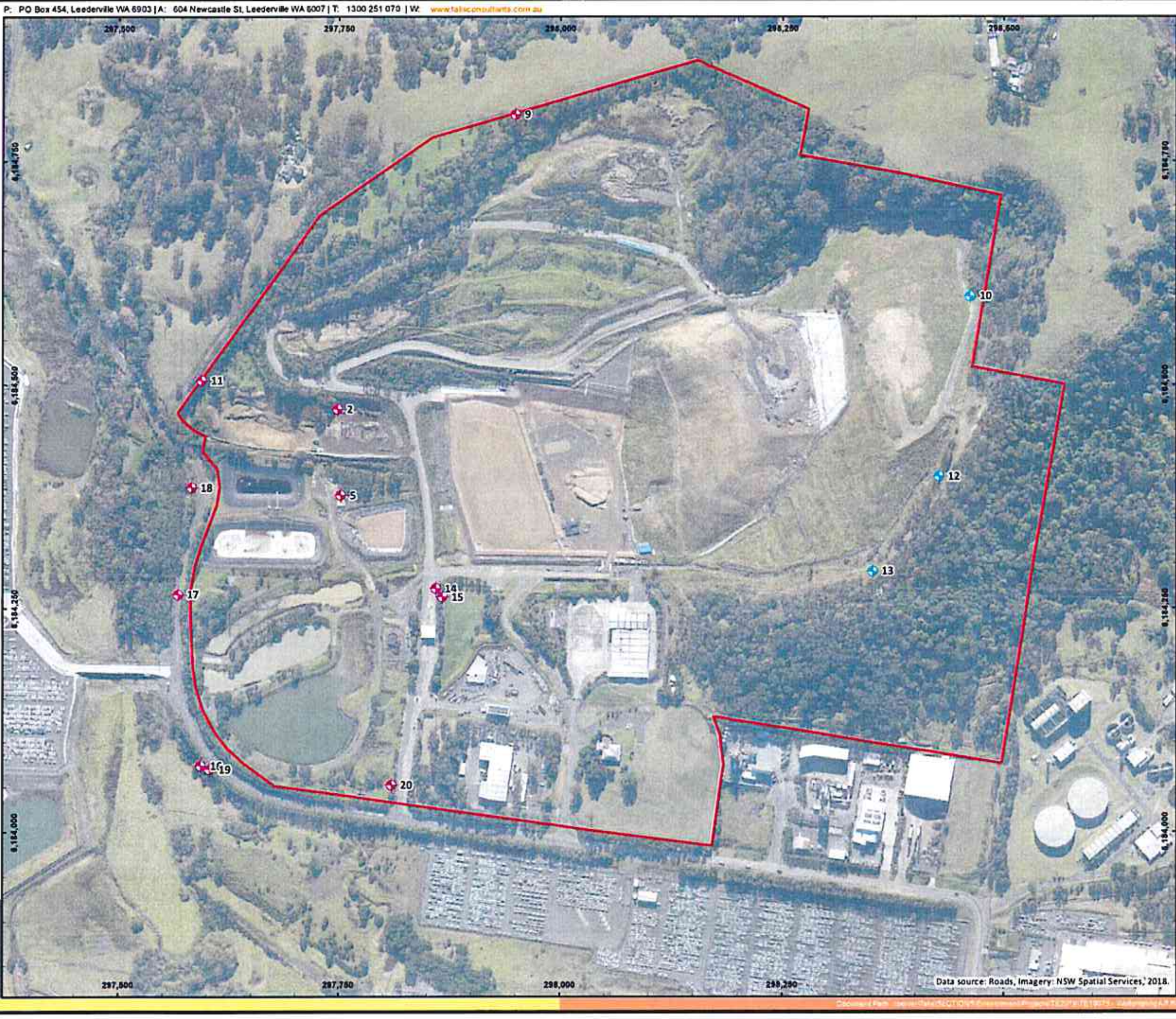
Figure 03

P: PO Box 454, Leederville WA 6903 | A: 604 Newcastle St, Leederville WA 6007 | T: 1300 251 070 | W: www.talisconsultants.com.au



LEGEND

- Site Boundary
- Dual Well (Groundwater and Gas)
- Groundwater Monitoring Well

GROUND WATER SAMPLING LOCATIONS

Whytes Gully Waste Disposal Facility

Annual Review Report 2018-2019

City of Wollongong

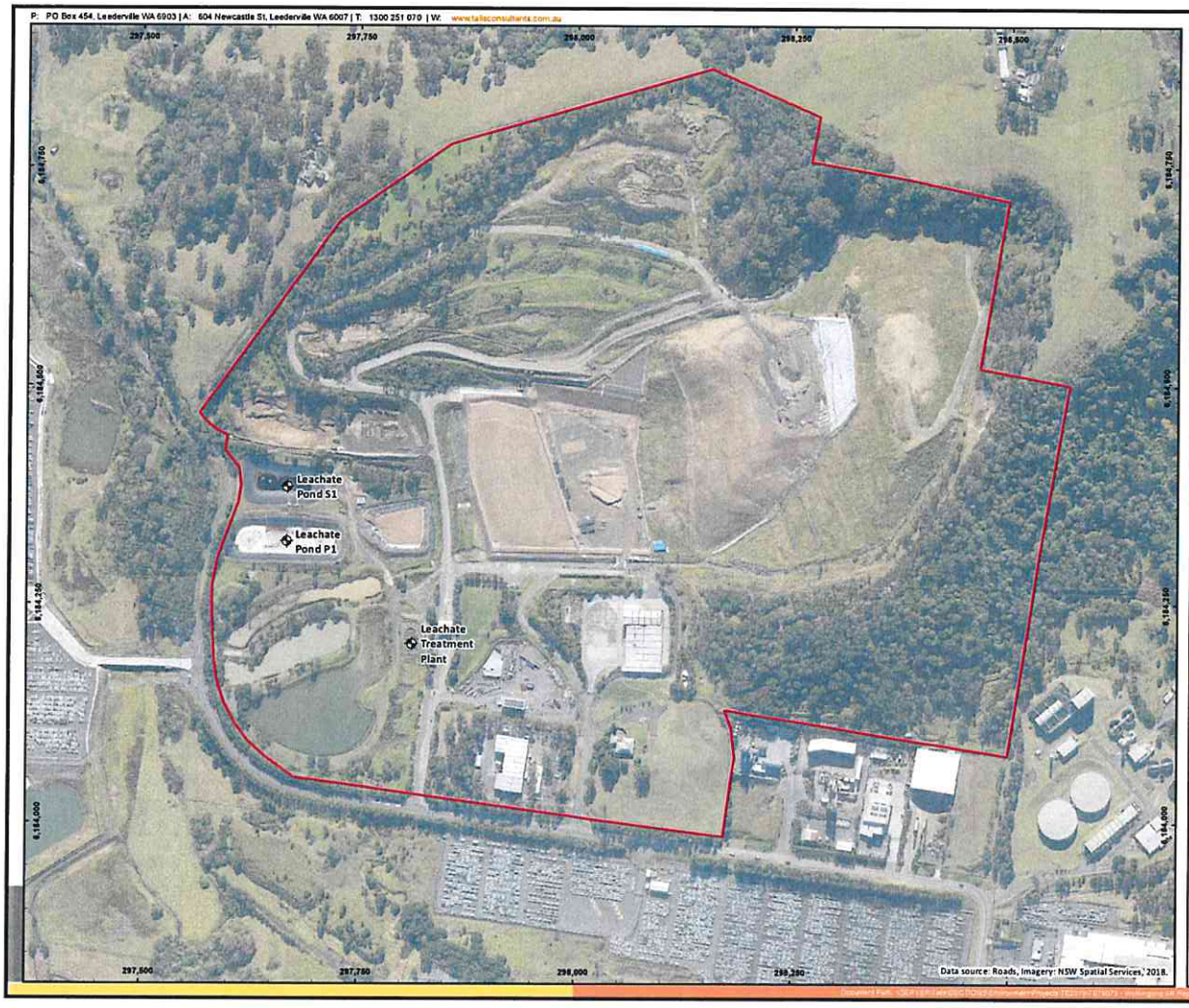
0 40 80 120 160 m

Coordinate System: GDA 1994 MGA Zone 56
Projection: Transverse Mercator, Datum: GDA 1994
Scale @A3 1:4,000

Prepared: F Walker	Date: 24/09/2019
Reviewed: J S-Bingham	Project No: TE19075

Figure 04

P: PO Box 454, Leederville WA 6903 | A: 604 Newcastle St, Leederville WA 6007 | T: 1300 251 070 | W: www.talisconsultants.com.au



LEGEND

- Site Boundary
- Trade Wastewater and Leachate Monitoring Point

LOCALITY

TRADE WASTEWATER AND LEACHATE
Whytes Gully Waste Disposal Facility

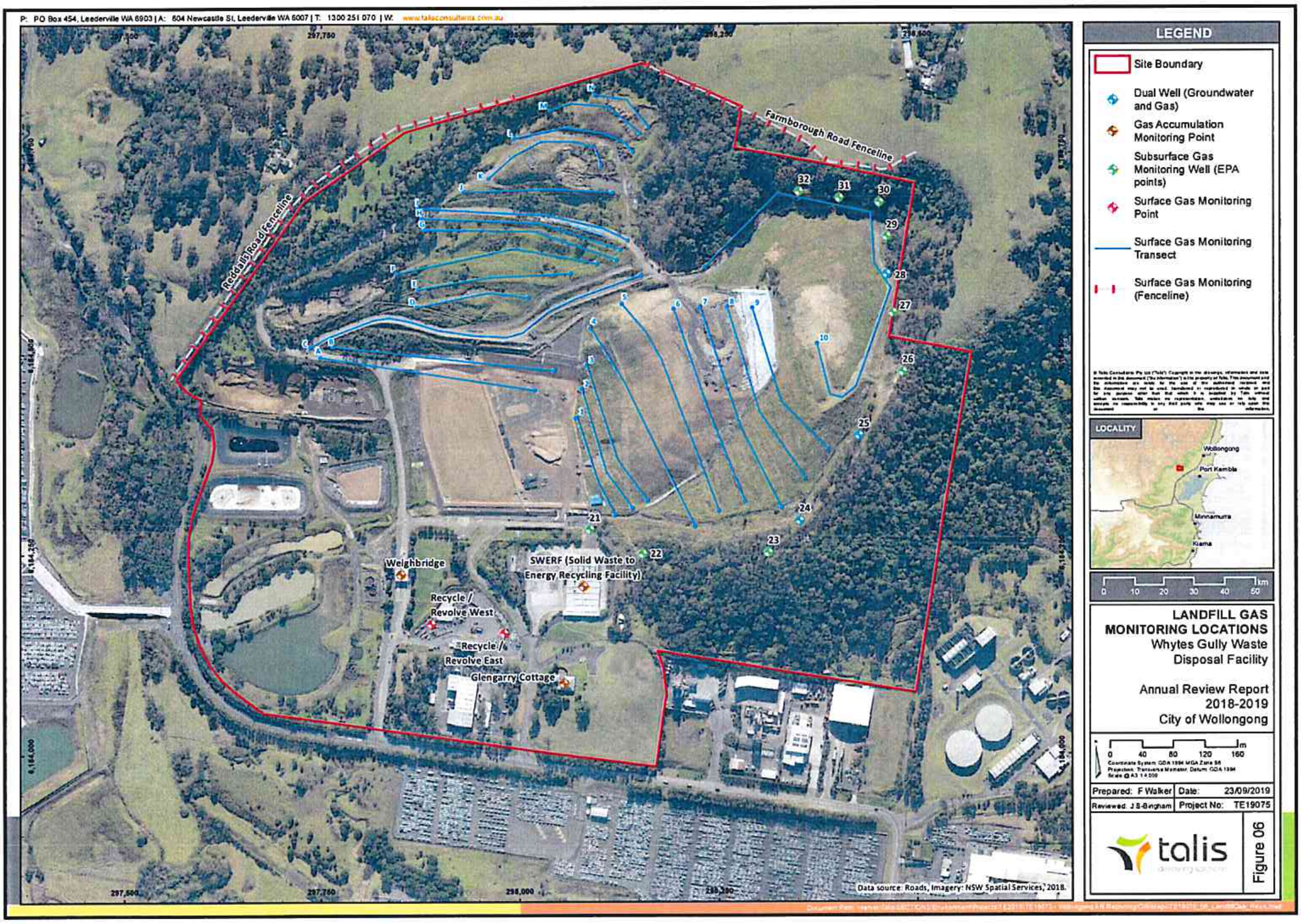
Annual Review Report 2018-2019
City of Wollongong

0 40 80 120 160 m
Coordinate System: GDA 1994 MGA Zone 56
Projection: Transverse Mercator, Datum: GDA 1994
Scale @ A3: 1:4,000

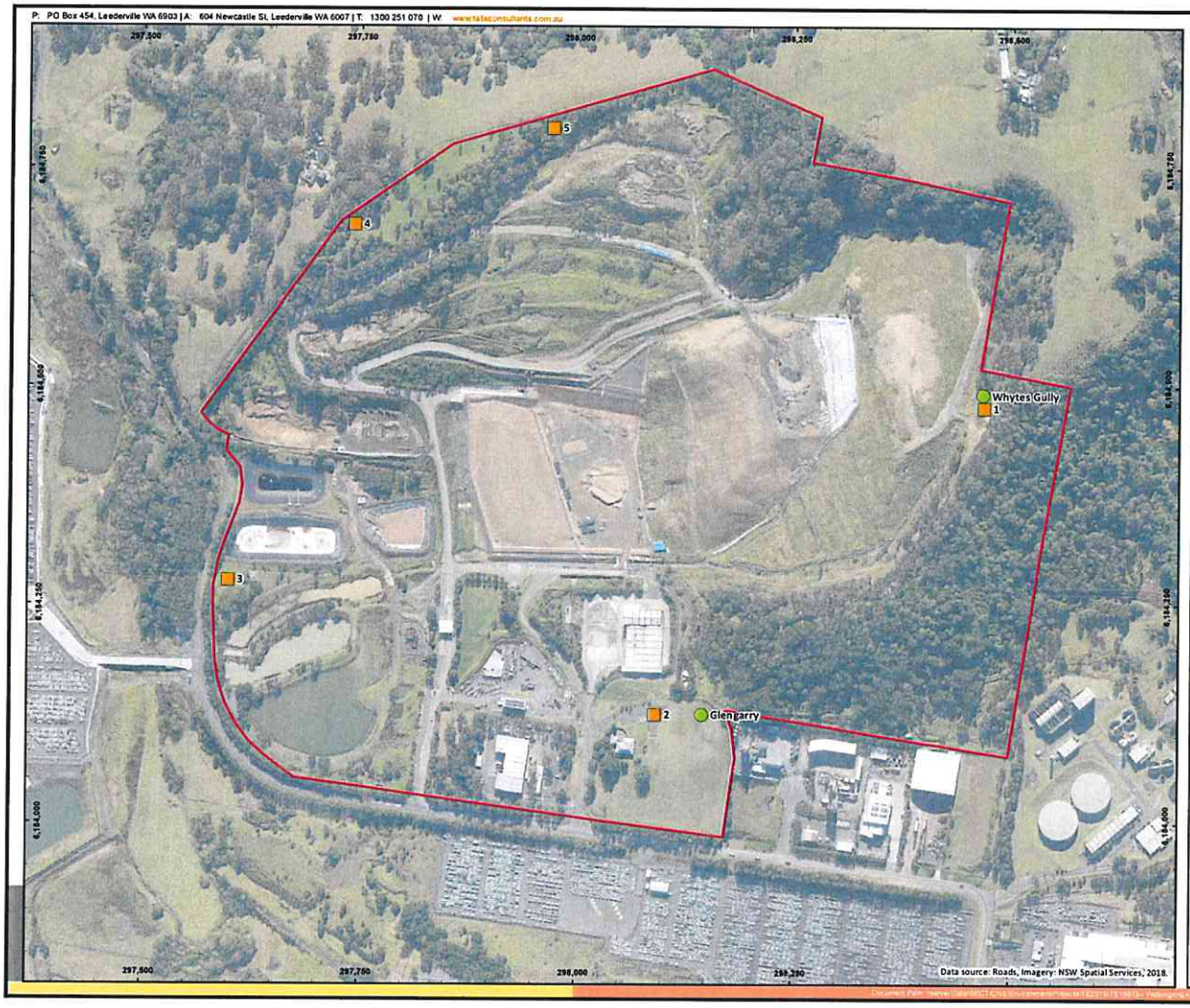
Prepared: F Walker	Date: 17/09/2019
Reviewed: J.S-Bingham	Project No: TE19075

talis delivering solutions

Figure 05


P: PO Box 454, Leederville WA 6903 | A: 604 Newcastle St, Leederville WA 6007 | T: 1300 251 070 | W: www.talisconsultants.com.au
297,500
297,750
298,000
298,250
298,500
Reddalls Road Fenceline
Farmborough Road Fenceline
32
31
30
29
28
27
26
25
24
23
22
21
10
Weighbridge
SWERF (Solid Waste to Energy Recycling Facility)
Recycle / Revolve West
Recycle / Revolve East
Glengarry Cottage
Data source: Roads, Imagery: NSW Spatial Services, 2018.
LEGEND
Site Boundary
Dual Well (Groundwater and Gas)
Gas Accumulation Monitoring Point
Subsurface Gas Monitoring Well (EPA points)
Surface Gas Monitoring Point
Surface Gas Monitoring Transect
Surface Gas Monitoring (Fenceline)
LOCALITY
Wollongong
Port Kembla
Minnamurra
Kiama
0 10 20 30 40 50 km
LANDFILL GAS MONITORING LOCATIONS
Whytes Gully Waste Disposal Facility
Annual Review Report 2018-2019
City of Wollongong
0 40 80 120 160 m
Prepared: F Walker
Date: 23/09/2019
Reviewed: J S-Bingham
Project No: TE19075
talis
Figure 06

P: PO Box 454, Lederville WA 6903 | A: 604 Newcastle St, Lederville WA 6007 | T: 1300 251 070 | W: www.talisconsultants.com.au



LEGEND

- Site Boundary

Dust Deposition Monitoring Locations

- Dust Gauge Deposition Gauge Location
- High Volume Sampling Location

LOCALITY

DUST MONITORING LOCATIONS
Whytes Gully Waste Disposal Facility

Annual Review Report 2018-2019
City of Wollongong

0 40 80 120 160 m

Coordinate System: GDA 1994 MGA Zone 56
Projection: Transverse Mercator. Datum: GDA 1994
Scale @ A3: 1:4,000

Prepared: F Walker	Date: 23/09/2019
Reviewed: J.S-Bingham	Project No: TE19075

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Figure 07

Appendix A: Surface Water: Tabulated Results and Trends

Table 1: **Surface Water Results**
Client: Wollongong City Council

EPA Designation	Sample ID	Sample Date	Alkalinity (as Calcium Carbonate)	Ammonia	Calcium	Chloride	Conductivity	Dissolved Oxygen	Dissolved Oxygen	Filterable Iron	Fluoride	Magnesium	Nitrate	Potassium
			mg/L	mg/L	mg/L	mg/L	µS/cm	mg/L	% Saturation	mg/L	mg/L	mg/L	mg/L	mg/L
PQL			1	0.01	1	1	1	0.01		0.05	0.1	1	0.01	1
ANZECC 2000 Fresh Water (95%)													0.7	
EPL 5862 Discharge Point (Point 1) Criteria														
1	Discharge Point	11/10/2018	211	0.08	40	181	973	8.43	87	1.28	0.4	26	0.34	10
		11/02/2019	208	0.11	49	102.00	719	6.41	71	0.12	0.4	22	0.11	3
33	Upstream	11/10/2018	88	0.06	22	26	277	8.46	88	0.8	0.1	7	0.06	2
		11/02/2019	92	0.05	15	19	201	5.2	59	0.27	0.1	4	0.03	2
34	Downstream	11/10/2018	164	0.04	46	55	554	11	115	0.24	0.1	19	0.02	4
		11/02/2019	202	0.02	48	49	551	4.31	47	0.09	0.2	21	< 0.01	4

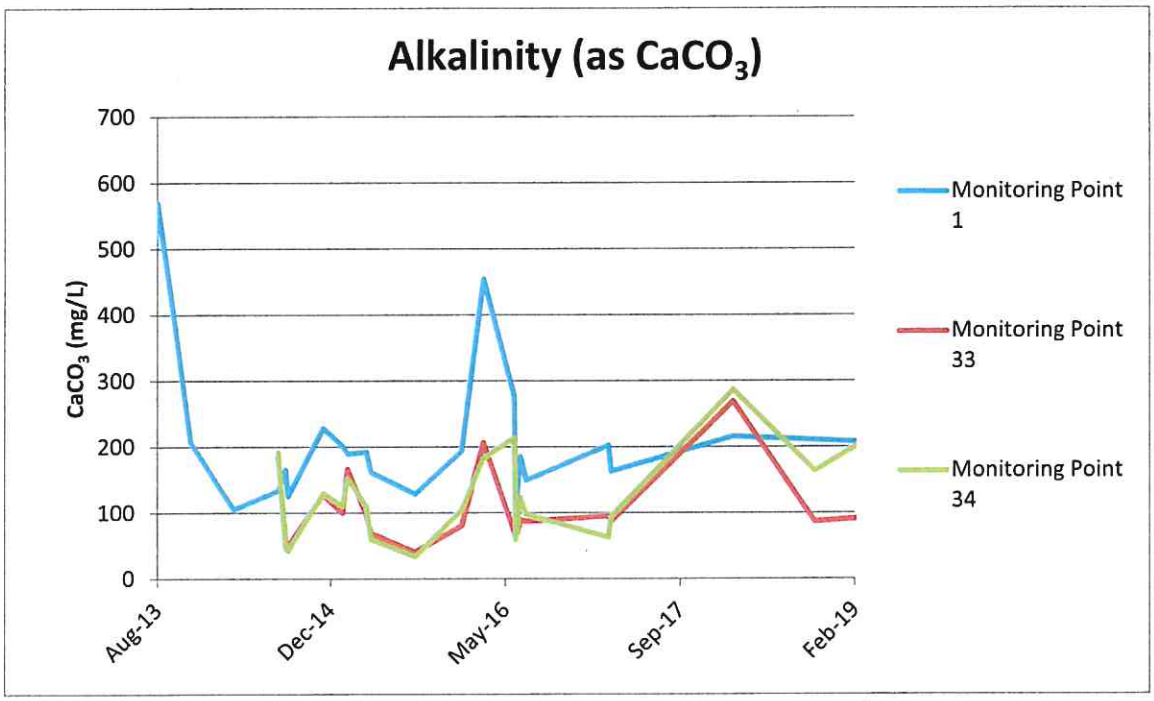
Table 1: **Surface Water Results**
Client: Wollongong City Council

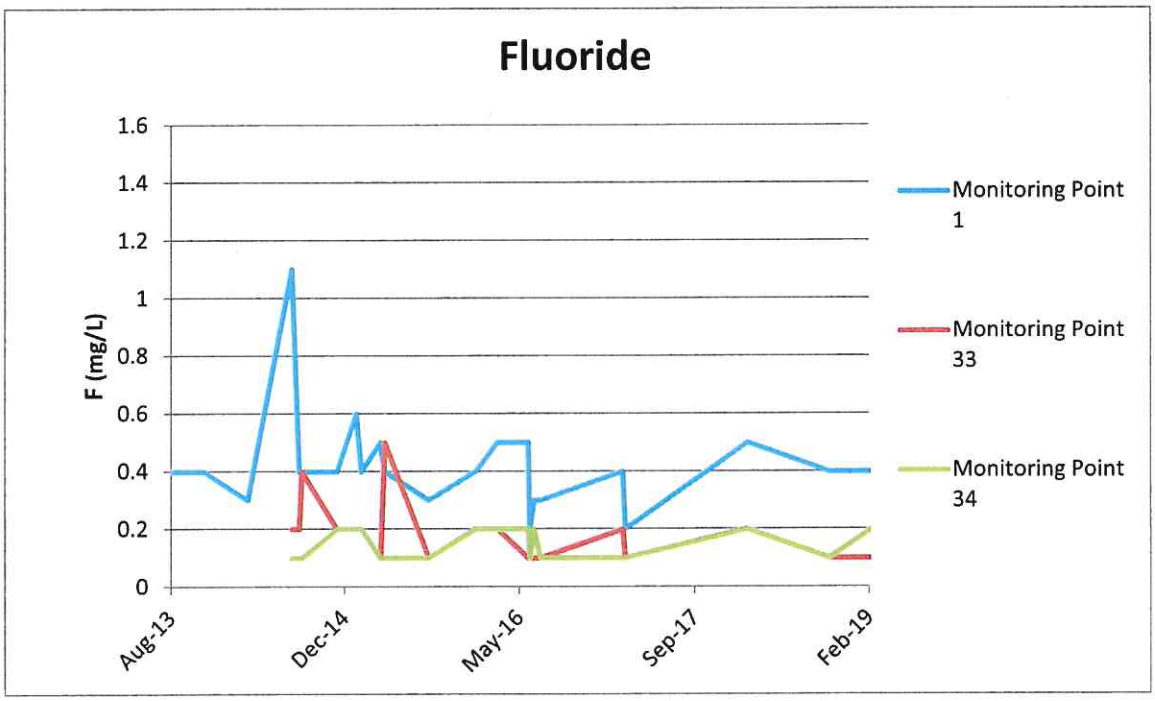
EPA Designation	Sample ID	Sample Date	Sodium	Sulfate	Temperature	Total Phenolics	Total Organic Carbon	Total Suspended Solids	pH
			mg/L	mg/L	°c	mg/L	mg/L	mg/L	pH
PQL			1	1	1	0.05	1	1	0.01
ANZECC 2000 Fresh Water (95%)						0.32			
EPL 5862 Discharge Point (Point 1) Criteria								50	6.5-8.5
1	Discharge Point	11/10/2018	132	67	17	< 0.05	26	27	8.3
		11/02/2019	73	18	20.1	< 0.05	11	21	7.8
33	Upstream	11/10/2018	26	17	17.4	< 0.05	4	< 5	7.5
		11/02/2019	21	12	21.1	< 0.05	6	10	7.1
34	Downstream	11/10/2018	42	34	17.4	< 0.05	3	5	8.3
		11/02/2019	42	23	19.7	< 0.05	7	9	7.4

Table 2: **Polishing Pond Results**
Client: Wollongong City Council

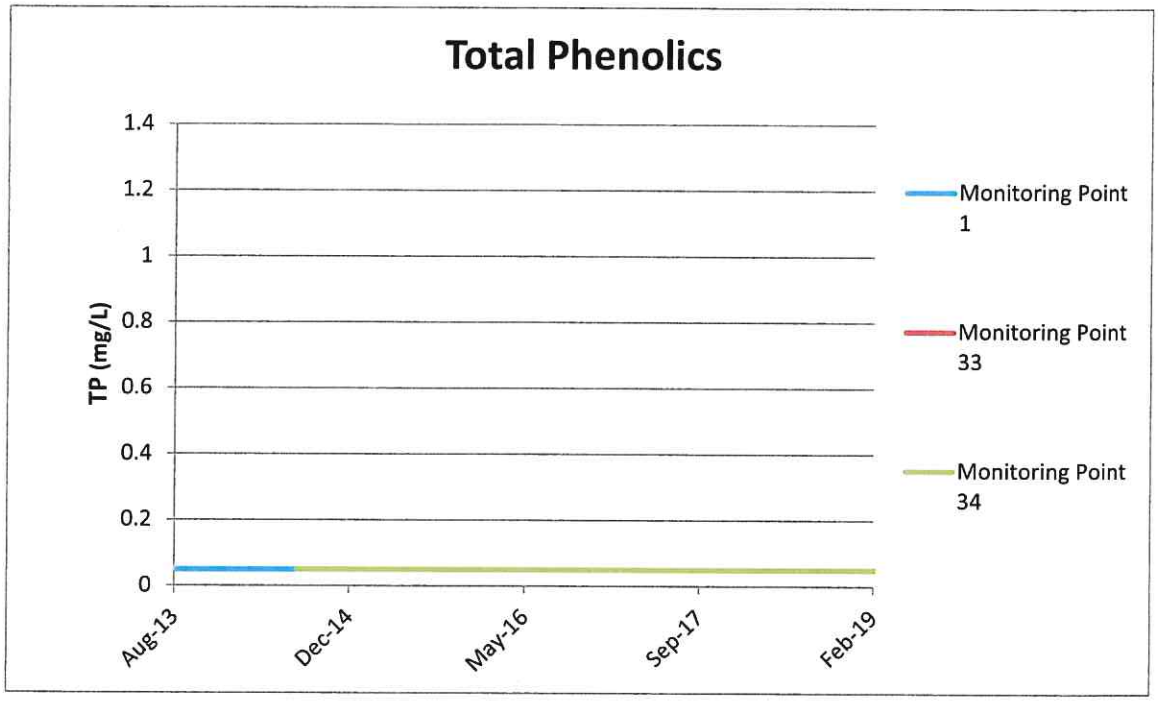
Date	time	Rainfall (mm)	WCC on Site testing Location PPL Council Turbidimeter (NTU) <40 NTU	WCC on site testing PPL PH	ALS Report Polishing Pond - pH 6.5-8.5	ALS Report Polishing Pond -TSS <50mg/L	ALS Report Polishing Pond - Turbidity
5/03/2018	8.00am		54.1	8.4	8.3	5	50.9
6/03/2018	9.00am		60.7	8.49			
8/03/2018	10.00am		48	8.09			
9/03/2018	10.00am		44.3	8.46		30.5	
12/03/2018	11.00am		33.4	8	7.8	<5	33.4
13/03/2018	10.00am		35.8	8.03			
19/03/2018	11.00am		25.3	8.22			
4/04/2018	2.00pm		11.24	8.5			
29/06/2018	7.45am		10.45	8.37			
2/07/2018	8.45am		13	8.49			
3/10/2018	12.30pm		28	8.5			
10/10/2018	11.00am	OVERFLOW	50.7	8.49	8.49	17	
11/10/2018		OVERFLOW				27	
12/10/2018		OVERFLOW					
13/10/2018		OVERFLOW					
15/10/2018			57.6	8.46			
16/10/2018			52.4	8.45			
17/10/2018			62.8	8.48			
18/10/2018			72.3	8.48	8	40	
19/10/2018			57.8	8.47			
22/10/2018			50.5	8.55			
23/10/2018			54.1	8.49			
30/10/2018	11.15am		25.7	9.02			
31/10/2018	9.15am		19.6	8.31			
8/11/2018			13.25	8.5			
9/11/2018	8.45am		18.27	8.5			
3/12/2018	11.00am		117	8.27			
12/12/2018	8.00am		58.4	8.29	8.1		
13/12/2018			29.9	8.08			
14/12/2018			39.7	8.08			
15/12/2018			14.89	8.05			
17/12/2018			5.97	8.18			
18/12/2018			9.12	8.6			
19/12/2018			14.66	8.5			
15/01/2019			30	8.88			
17/01/2018			25.2	8.43			
25/01/2019			6.94	8.3			
29/01/2019			11.21	8			
15/02/2019			35.3	8.61			
19/02/2019			26	8.5			

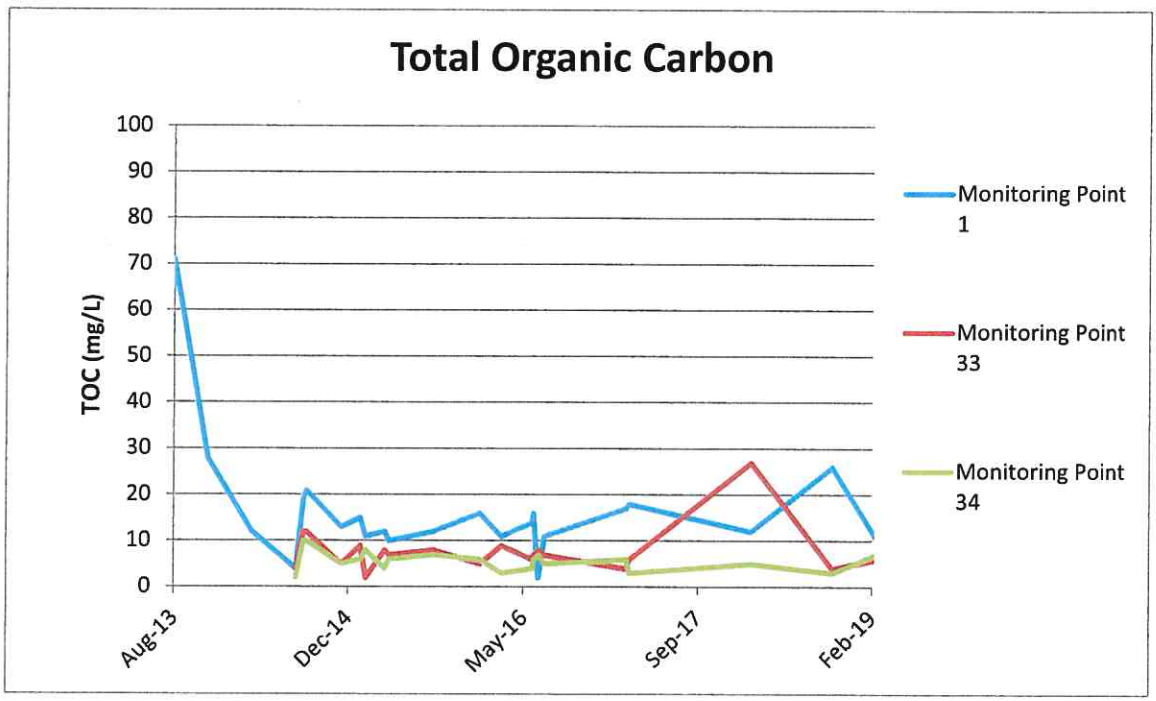
Whytes Gully Surface Water



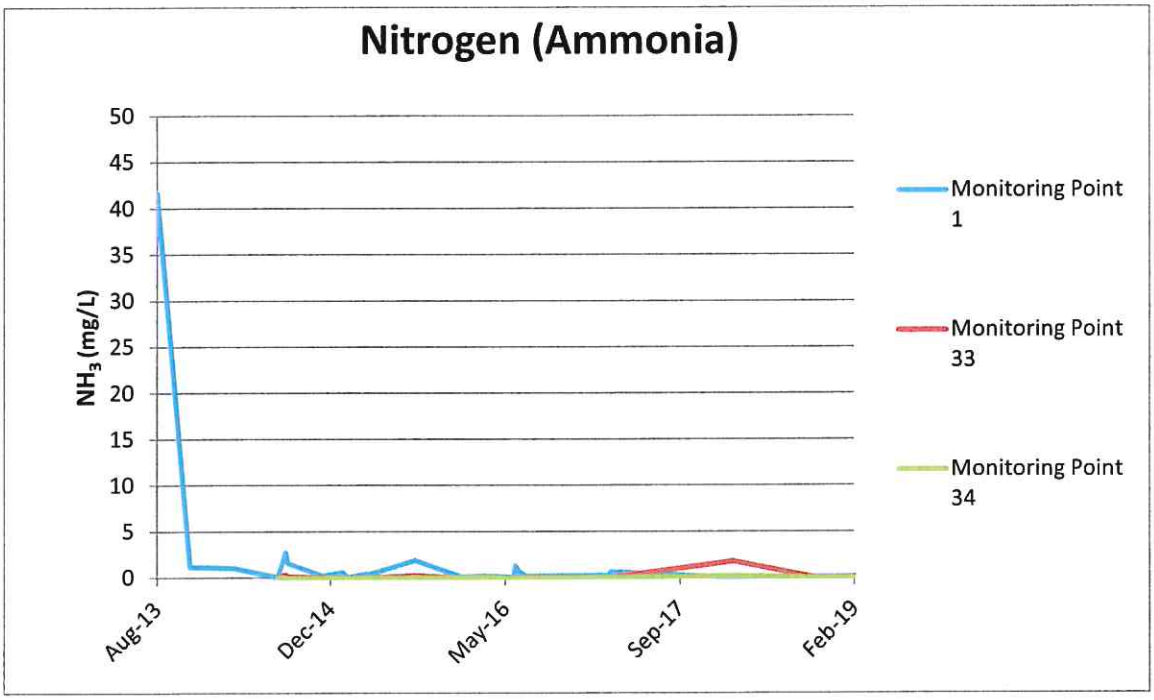


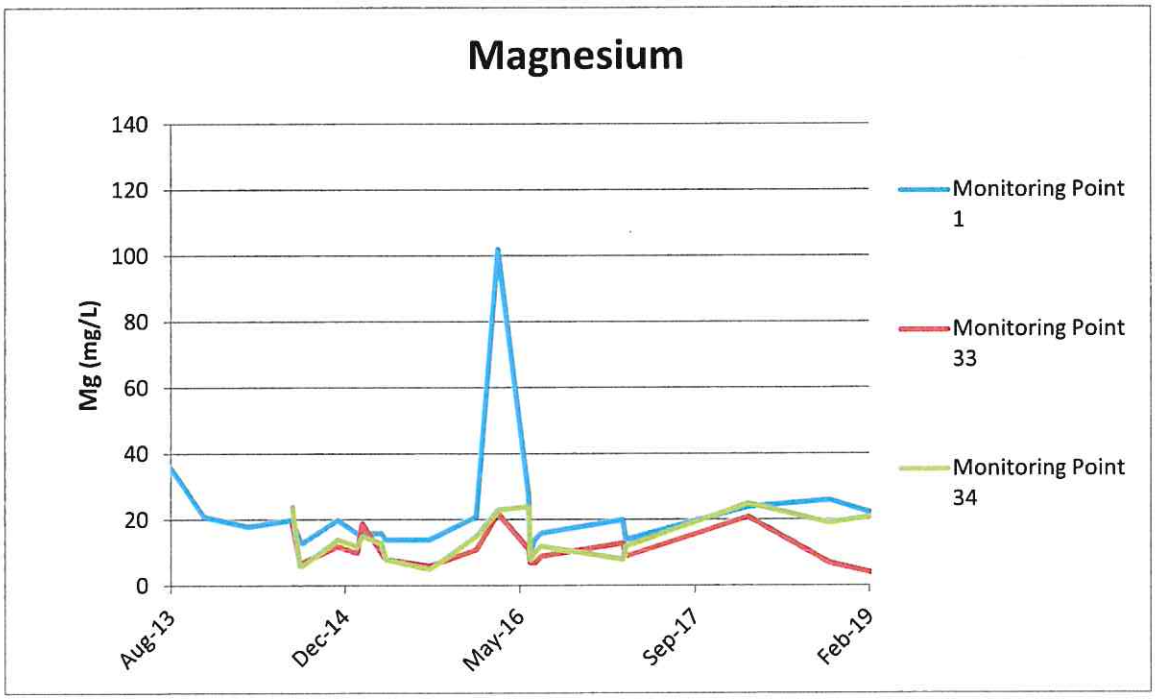
Whytes Gully Surface Water



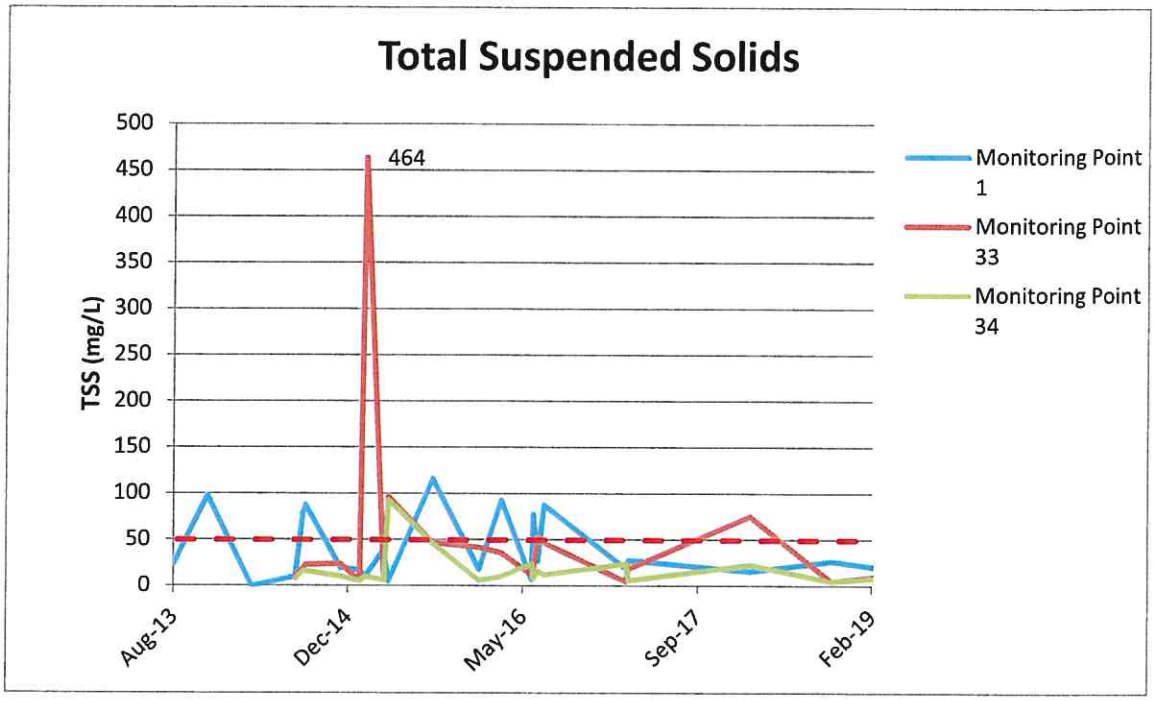


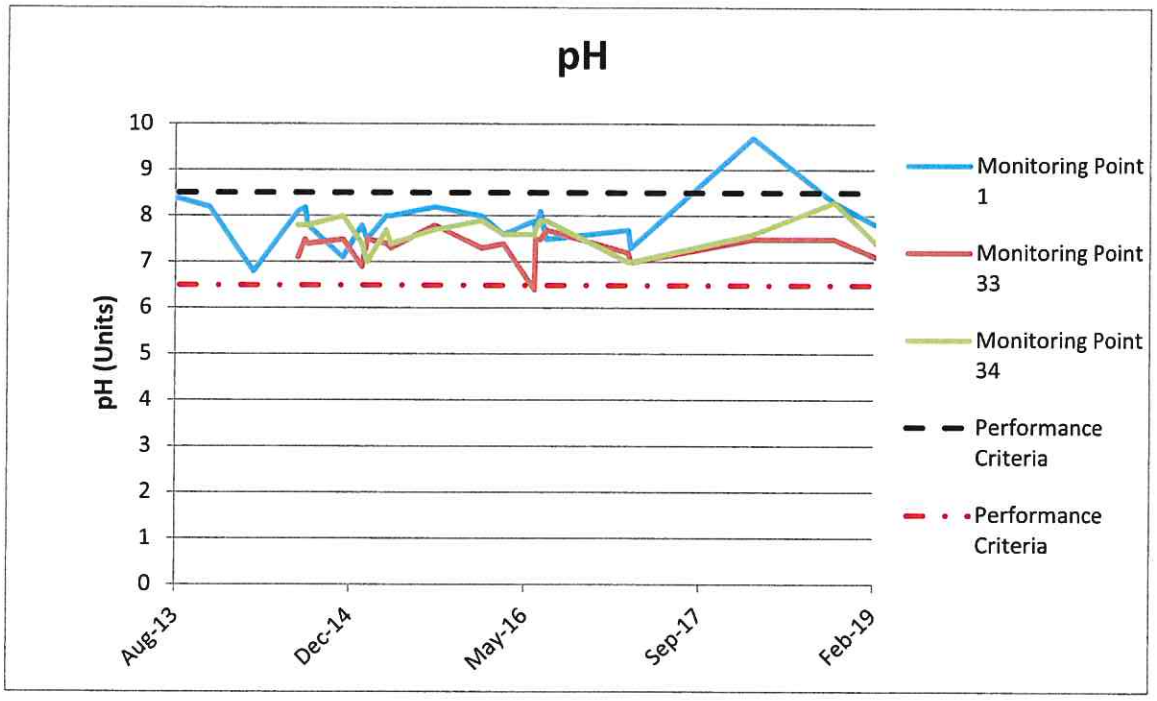
Whytes Gully Surface Water



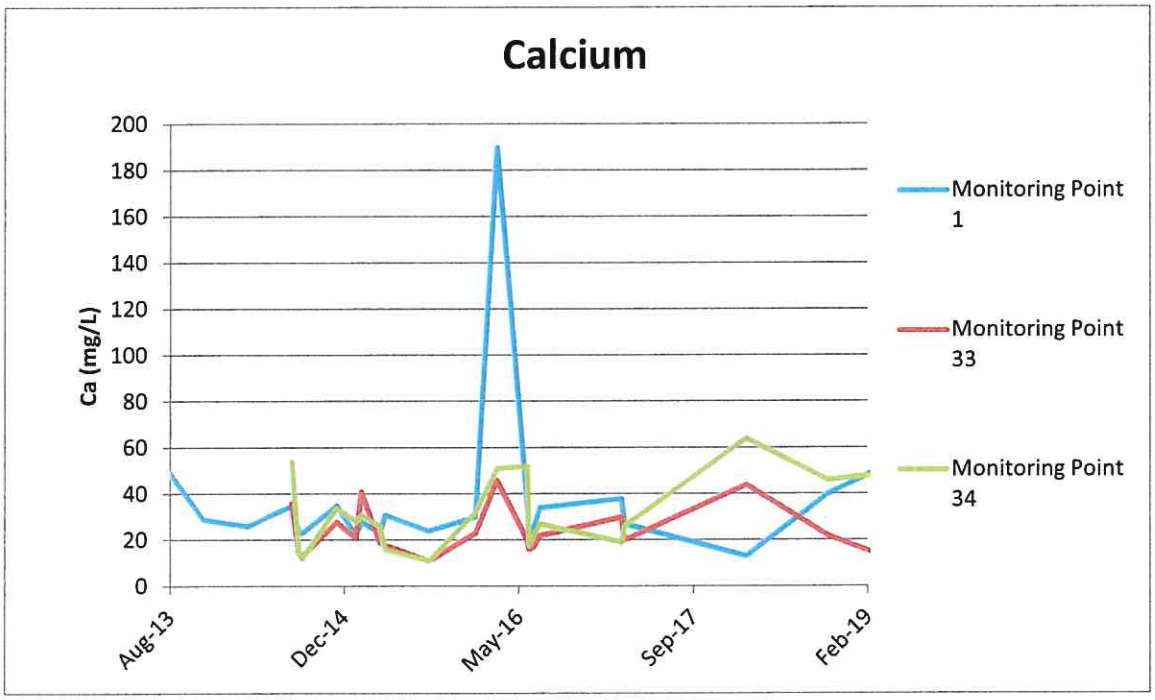


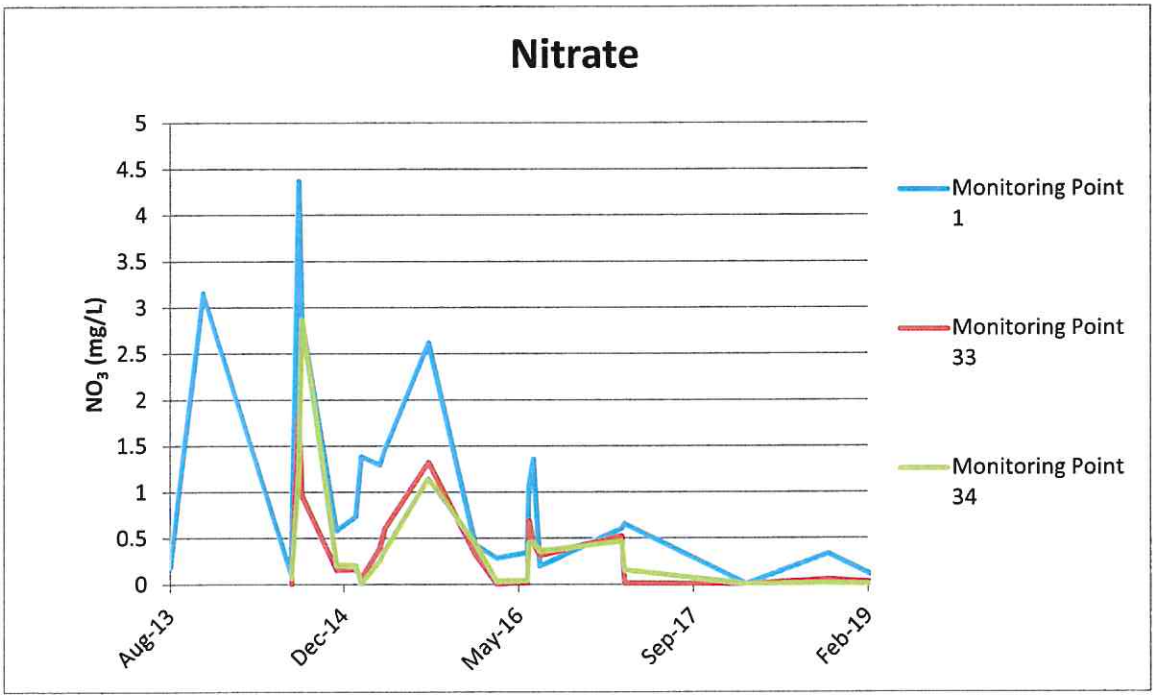
Whytes Gully Surface Water



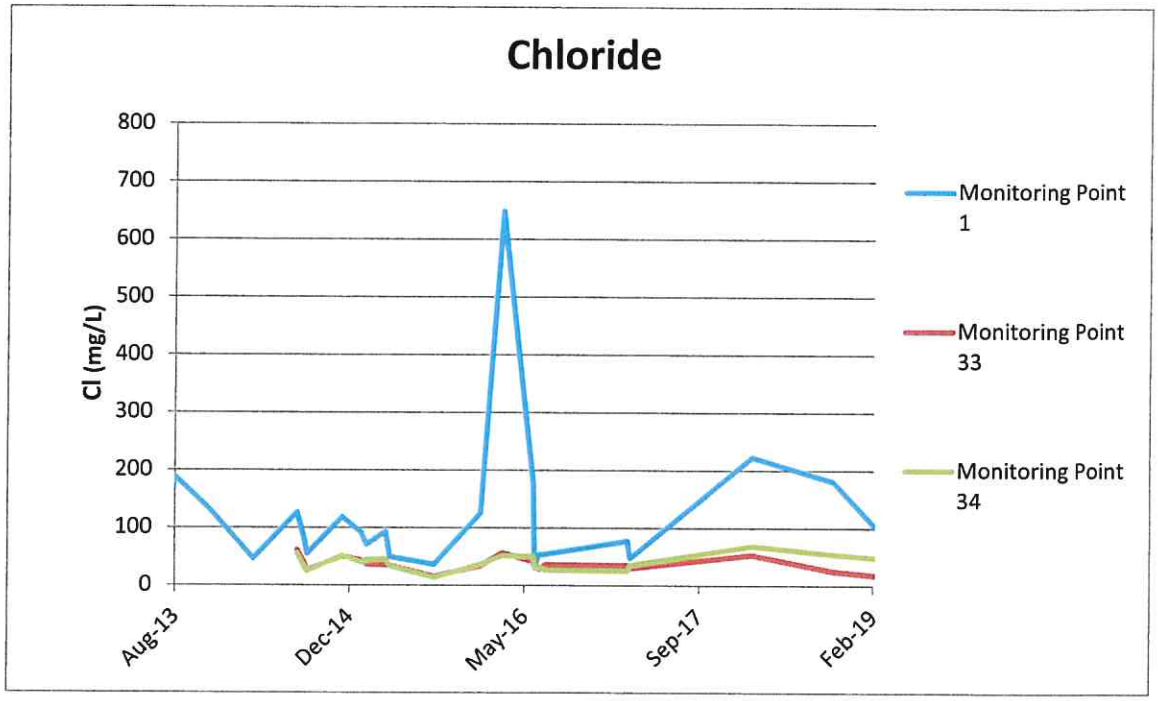


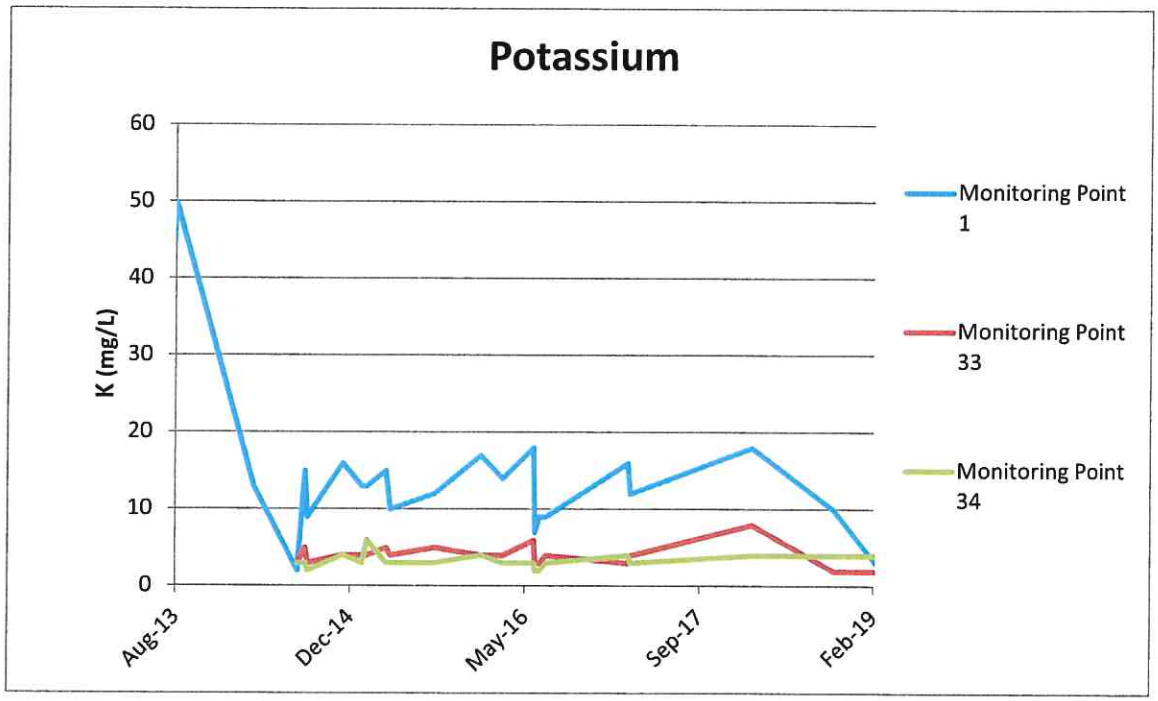
Whytes Gully Surface Water



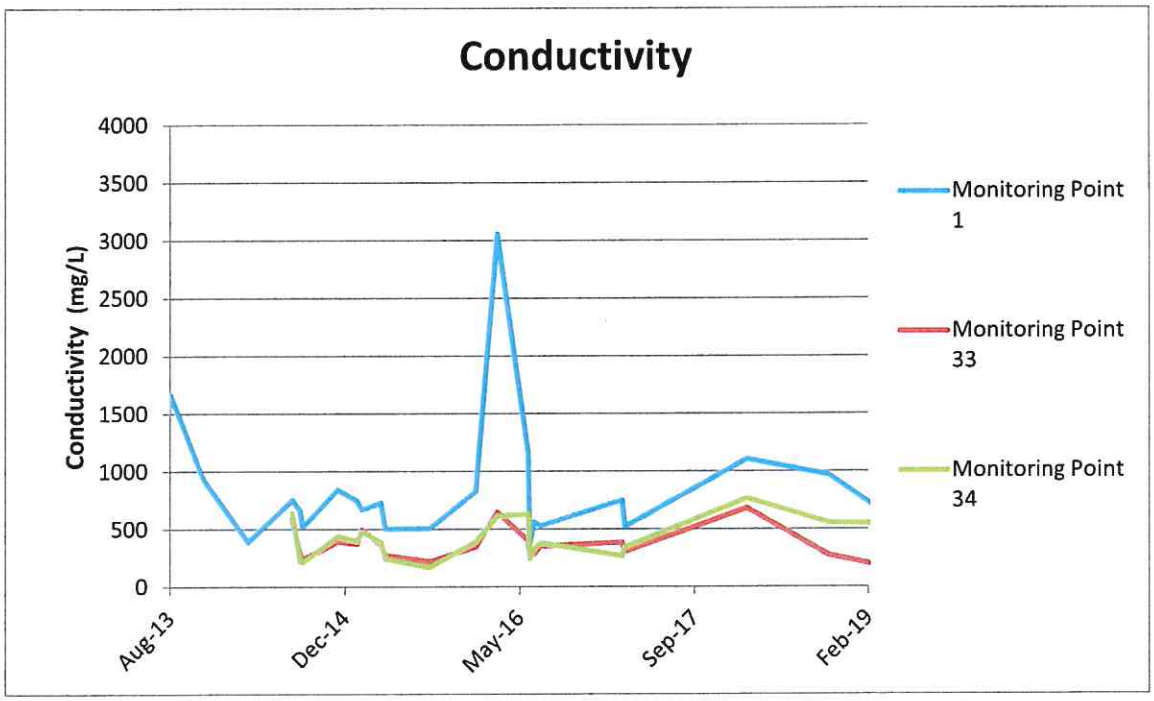


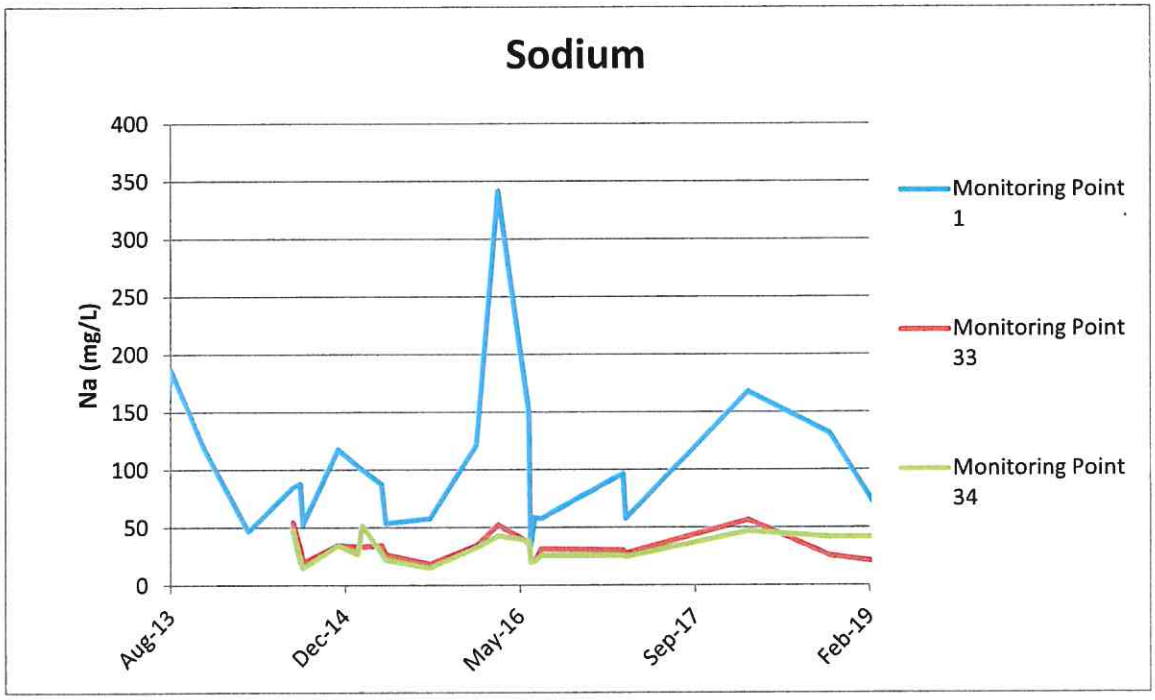
Whytes Gully Surface Water





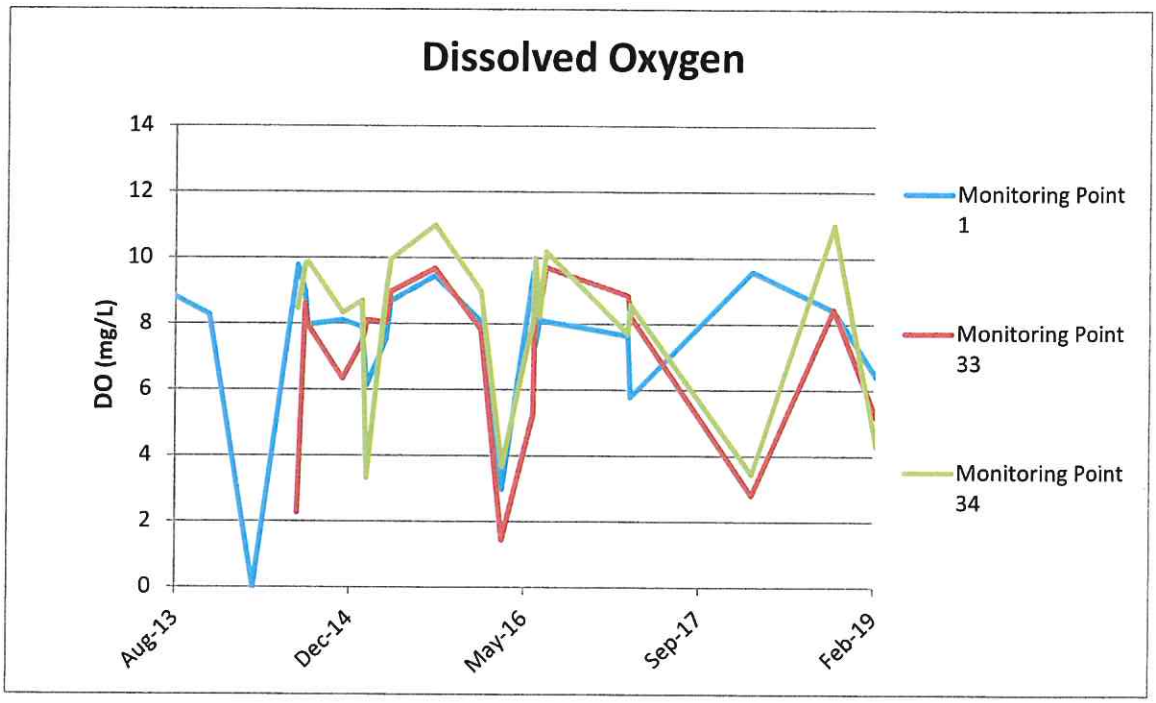
Whytes Gully Surface Water

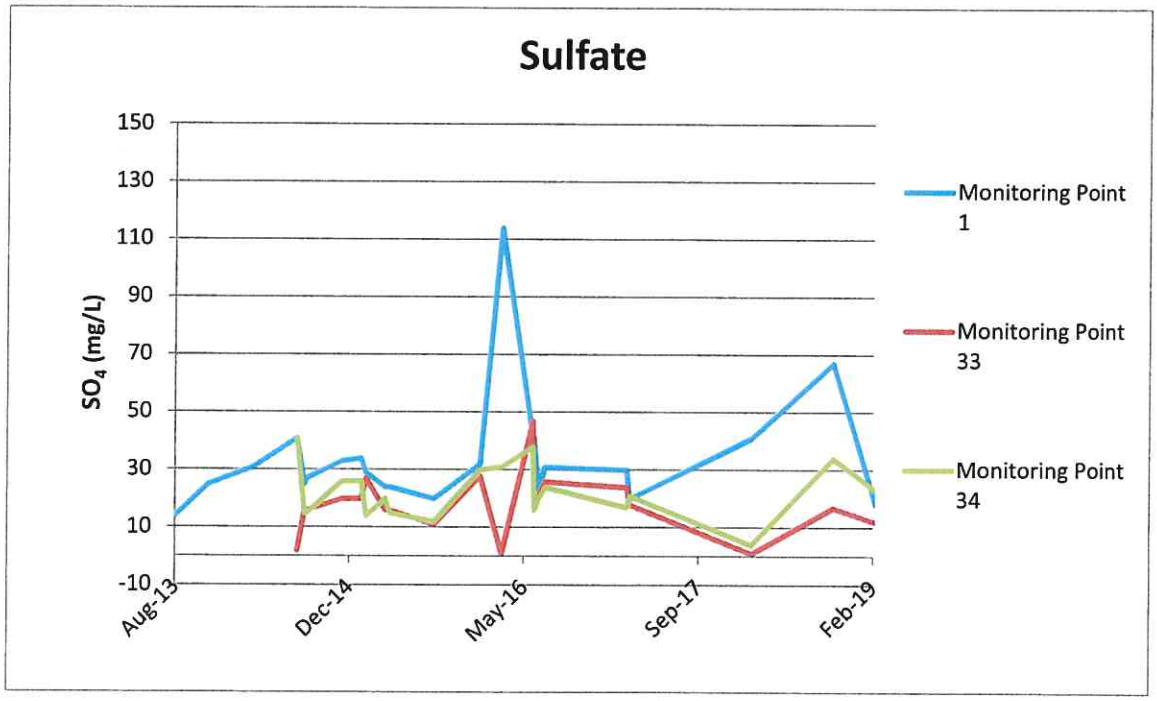




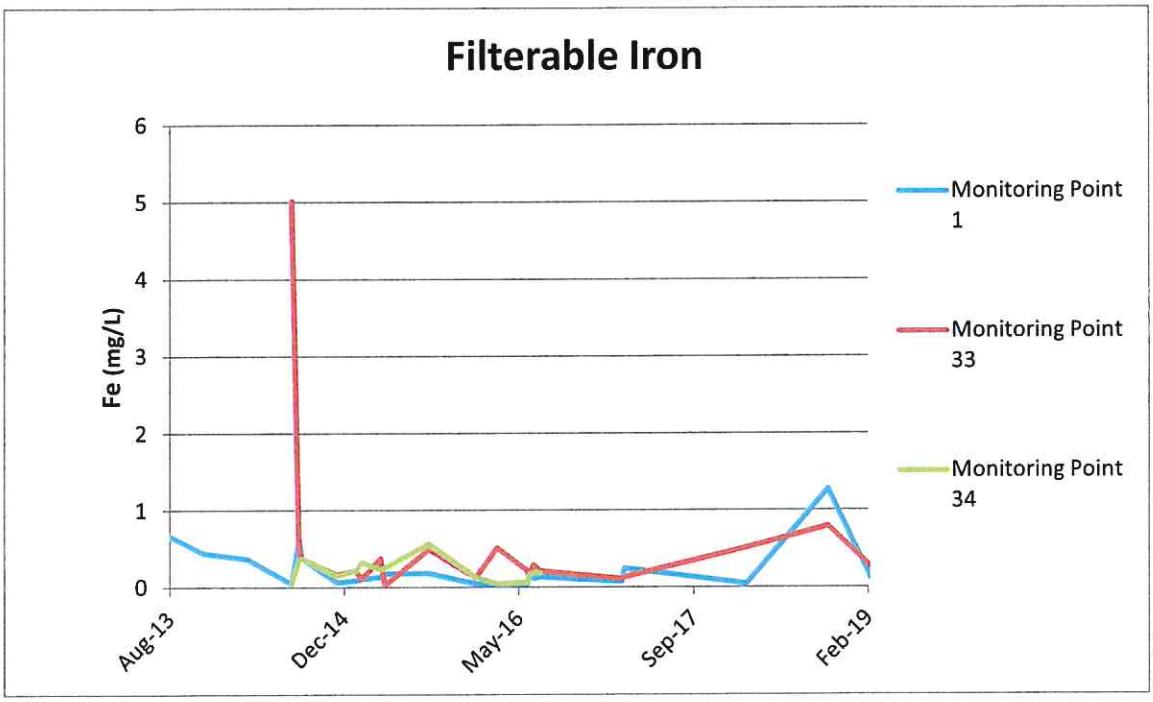
Whytes Gully

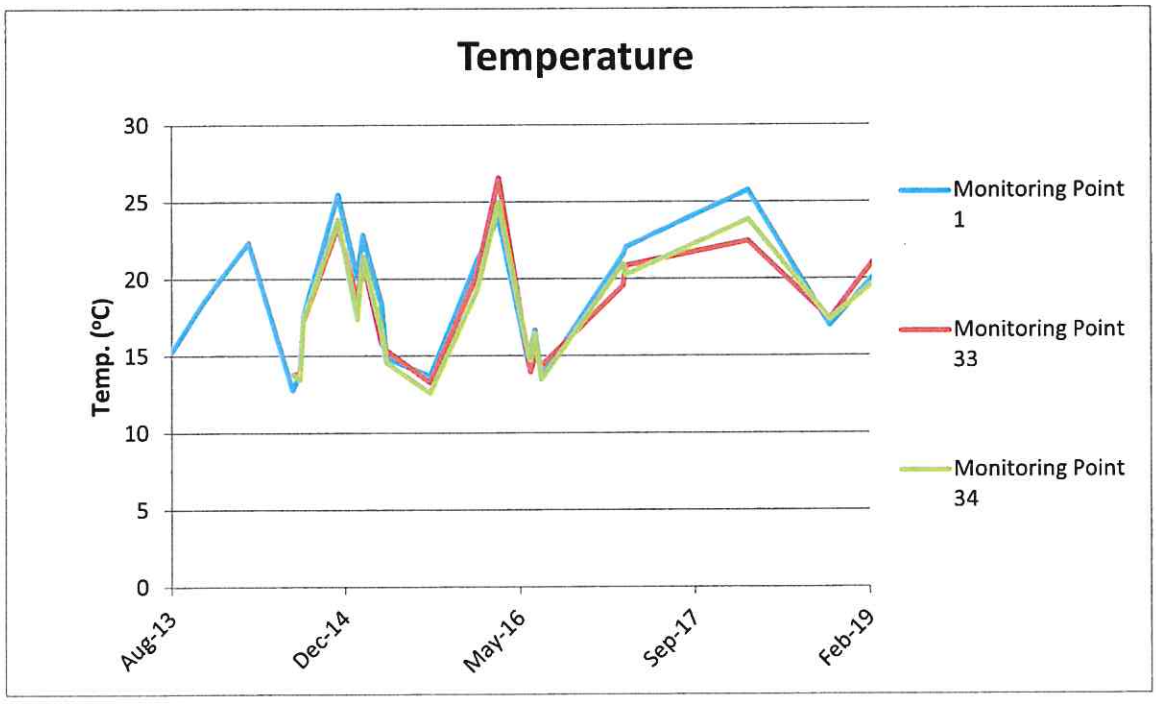
Surface Water





Whytes Gully Surface Water





Appendix B: Groundwater: Tabulated Results and Trends

Table 1: **Groundwater Results**
Client: Wollongong City Council

EPA Destination	Sample ID	Sample Date		Metals								
			Standing Water Level	Aluminium	Arsenic	Barium	Cadmium	Chromium (Hexavalent)	Chromium (Total)	Cobalt	Copper	Lead
			m	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL				0.01	0.001	0.001	0.0001	0.01	0.0001	0.001	0.001	0.001
ANZECC 2000 Fresh Water (95%)				0.055	0.013		0.0002	0.001	0.0033		0.0014	0.0034
Metals Hardness Modified Trigger Values		Very Hard (180-240 mg/L as $CaCO_3$)					0.00114		0.01617			0.04012
		Extremely Hard (>240 mg/L as $CaCO_3$)					0.002		0.02772			0.09078
5	GABH02	22/05/2018	5.56	-	-	-	-	-	-	-	-	-
		14/08/2018	5.58	-	-	-	-	-	-	-	-	-
		8/11/2018	5.54	-	-	-	-	-	-	-	-	-
		11/02/2019	5.37	6.61	< 0.001	0.015	< 0.0001	< 0.01	0.005	0.002	0.015	0.004
9	GMW102	22/05/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		14/08/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		8/11/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		11/02/2019	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
10	GMW103	22/05/2018	7.75	-	-	-	-	-	-	-	-	-
		14/08/2018	3.85	-	-	-	-	-	-	-	-	-
		8/11/2018	7.87	-	-	-	-	-	-	-	-	-
		11/02/2019	7.52	3.19	< 0.001	0.026	< 0.0001	< 0.01	0.004	0.006	0.011	0.006
11	GMW104	22/05/2018	7.90	7.49	-	0.037	0.0001	-	-	0.004	0.011	0.004
		14/08/2018	3.32	7.56	-	0.041	< 0.0001	-	0.004	0.005	0.01	0.004
		8/11/2018	8.06	10.8	-	0.072	0.0001	-	0.006	0.006	0.016	0.005
		11/02/2019	7.95	12.6	< 0.001	0.038	< 0.0001	< 0.01	0.007	0.01	0.026	0.007
12	GMW105	22/05/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		14/08/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		8/11/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		11/02/2019	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
13	GMW106	22/05/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		14/08/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		8/11/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		11/02/2019	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
14	GMW108S	22/05/2018	2.96	-	-	-	-	-	-	-	-	-
		14/08/2018	3.22	-	-	-	-	-	-	-	-	-
		8/11/2018	2.96	-	-	-	-	-	-	-	-	-
		11/02/2019	2.94	11.9	0.001	0.209	< 0.0001	< 0.01	0.01	0.009	0.039	0.047

Table 1: **Groundwater Results**
Client: Wollongong City Council

EPA Destination	Sample ID	Sample Date		Metals								
			Standing Water Level	Aluminium	Arsenic	Barium	Cadmium	Chromium (Hexavalent)	Chromium (Total)	Cobalt	Copper	Lead
			m	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL				0.01	0.001	0.001	0.0001	0.01	0.0001	0.001	0.001	0.001
ANZECC 2000 Fresh Water (95%)				0.055	0.013		0.0002	0.001	0.0033		0.0014	0.0034
Metals Hardness Modified Trigger Values		Very Hard (180-240 mg/L as $CaCO_3$)					0.00114		0.01617			0.04012
		Extremely Hard (>240 mg/L as $CaCO_3$)					0.002		0.02772			0.09078
15	GMW108D	22/05/2018	2.87	-	-	-	-	-	-	-	-	-
		14/08/2018	2.74	-	-	-	-	-	-	-	-	-
		8/11/2018	2.56	-	-	-	-	-	-	-	-	-
		11/02/2019	2.51	0.09	< 0.001	0.017	< 0.0001	< 0.01	< 0.001	< 0.001	< 0.001	< 0.001
16	GMW109S	22/05/2018	3.59	4.76	-	0.226	0.0001	-	0.006	0.033	0.013	0.008
		14/08/2018	3.58	3.7	-	0.268	0.0002	-	-	0.044	0.018	0.017
		8/11/2018	3.29	5.68	-	0.188	< 0.0002	-	-	0.048	0.016	0.012
		11/02/2019	3.44	2.31	< 0.001	0.068	< 0.0001	< 0.01	0.003	0.016	0.009	0.004
17	GMW110	22/05/2018	4.35	-	-	-	-	-	-	-	-	-
		14/08/2018	4.47	-	-	-	-	-	-	-	-	-
		8/11/2018	4.28	-	-	-	-	-	-	-	-	-
		11/02/2019	4.25	2.29	< 0.001	0.008	< 0.0001	< 0.01	0.002	0.002	0.011	0.003
18	GMW111	22/05/2018	6.55	-	-	-	-	-	-	-	-	-
		14/08/2018	5.88	-	-	-	-	-	-	-	-	-
		8/11/2018	6.45	-	-	-	-	-	-	-	-	-
		11/02/2019	6.45	6.29	< 0.001	0.031	< 0.0001	< 0.01	0.004	0.007	0.016	0.007
19	GMW109D	22/05/2018	3.30	-	-	-	-	-	-	-	-	-
		14/08/2018	3.38	-	-	-	-	-	-	-	-	-
		8/11/2018	3.17	-	-	-	-	-	-	-	-	-
		11/02/2019	3.25	0.05	< 0.001	0.146	< 0.0001	< 0.01	< 0.01	< 0.001	0.003	< 0.001
20	BH6	22/05/2018	1.77	-	-	-	-	-	-	-	-	-
		14/08/2018	2.03	-	-	-	-	-	-	-	-	-
		8/11/2018	1.67	-	-	-	-	-	-	-	-	-
		11/02/2019	1.63	0.65	0.005	0.09	< 0.0001	< 0.01	0.002	0.008	0.011	0.009

Table 1: **Groundwater Results**
Client: Wollongong City Council

EPA Destination	Sample ID	Sample Date				BTEX								
			Manganese	Mercury	Zinc	Benzene	Ethyl Benzene	Toluene	(m & p) Xylene	(o) Xylene	Total Xylene	Aldrin + Dieldrin	Chlordane
			mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL			0.001	0.0001	0.005	1	2	2	2	2	2	0.5	0.5
ANZECC 2000 Fresh Water (95%)			1.9	0.0006	0.008	950			200	350			0.08
Metals Hardness Modified Trigger Values		Very Hard (180-240 mg/L as $CaCO_3$)			0.0416								
		Extremely Hard (>240 mg/L as $CaCO_3$)			0.072								
5	GABH02	22/05/2018	-	-	-	-	-	-	-	-	-	-	-
		14/08/2018	-	-	-	-	-	-	-	-	-	-	-
		8/11/2018	-	-	-	-	-	-	-	-	-	-	-
		11/02/2019	0.082	< 0.0001	0.035	< 1	< 2	< 2	< 2	< 2	< 2	< 0.5	< 0.5
9	GMW102	22/05/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		14/08/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		8/11/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		11/02/2019	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
10	GMW103	22/05/2018	-	-	-	-	-	-	-	-	-	-	-
		14/08/2018	-	-	-	-	-	-	-	-	-	-	-
		8/11/2018	-	-	-	-	-	-	-	-	-	-	-
		11/02/2019	0.141	< 0.0001	0.027	< 1	< 2	< 2	< 2	< 2	< 2	< 0.5	< 0.5
11	GMW104	22/05/2018	0.381	-	0.025	-	-	-	-	-	-	-	-
		14/08/2018	0.392	-	0.023	-	-	-	-	-	-	-	-
		8/11/2018	0.391	-	0.03	-	-	-	-	-	-	-	-
		11/02/2019	0.624	< 0.0001	0.044	< 1	< 2	< 2	< 2	< 2	< 2	< 0.5	< 0.5
12	GMW105	22/05/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		14/08/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		8/11/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		11/02/2019	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
13	GMW106	22/05/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		14/08/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		8/11/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		11/02/2019	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
14	GMW108S	22/05/2018	-	-	-	-	-	-	-	-	-	-	-
		14/08/2018	-	-	-	-	-	-	-	-	-	-	-
		8/11/2018	-	-	-	-	-	-	-	-	-	-	-
		11/02/2019	0.442	< 0.0001	0.047	< 1	< 2	< 2	< 2	< 2	< 2	< 0.5	< 0.5

Table 1: **Groundwater Results**
Client: Wollongong City Council

EPA Destination	Sample ID	Sample Date				BTEX							
			Manganese	Mercury	Zinc	Benzene	Ethyl Benzene	Toluene	(m & p) Xylene	(o) Xylene	Total Xylene	Aldrin + Dieldrin	Chlordane
			mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL			0.001	0.0001	0.005	1	2	2	2	2	2	0.5	0.5
ANZECC 2000 Fresh Water (95%)			1.9	0.0006	0.008	950			200	350			0.08
Metals Hardness Modified Trigger Values		Very Hard (180-240 mg/L as $CaCO_3$)			0.0416								
		Extremely Hard (>240 mg/L as $CaCO_3$)			0.072								
15	GMW108D	22/05/2018	-	-	-	-	-	-	-	-	-	-	-
		14/08/2018	-	-	-	-	-	-	-	-	-	-	-
		8/11/2018	-	-	-	-	-	-	-	-	-	-	-
		11/02/2019	0.031	< 0.0001	< 0.005	< 1	< 2	< 2	< 2	< 2	< 2	< 0.5	< 0.5
16	GMW109S	22/05/2018	3.540	-	0.055	-	-	-	-	-	-	-	-
		14/08/2018	4.62	-	0.109	-	-	-	-	-	-	-	-
		8/11/2018	3.93	-	0.074	-	-	-	-	-	-	-	-
		11/02/2019	1.33	< 0.0001	0.023	< 1	< 2	< 2	< 2	< 2	< 2	< 0.5	< 0.5
17	GMW110	22/05/2018	-	-	-	-	-	-	-	-	-	-	-
		14/08/2018	-	-	-	-	-	-	-	-	-	-	-
		8/11/2018	-	-	-	-	-	-	-	-	-	-	-
		11/02/2019	0.098	< 0.0001	0.021	< 1	< 2	< 2	< 2	< 2	< 2	< 0.5	< 0.5
18	GMW111	22/05/2018	-	-	-	-	-	-	-	-	-	-	-
		14/08/2018	-	-	-	-	-	-	-	-	-	-	-
		8/11/2018	-	-	-	-	-	-	-	-	-	-	-
		11/02/2019	0.369	< 0.0001	0.036	< 1	< 2	< 2	< 2	< 2	< 2	< 0.5	< 0.5
19	GMW109D	22/05/2018	-	-	-	-	-	-	-	-	-	-	-
		14/08/2018	-	-	-	-	-	-	-	-	-	-	-
		8/11/2018	-	-	-	-	-	-	-	-	-	-	-
		11/02/2019	0.053	< 0.0001	0.006	< 1	< 2	< 2	< 2	< 2	< 2	< 0.5	< 0.5
20	BH6	22/05/2018	-	-	-	-	-	-	-	-	-	-	-
		14/08/2018	-	-	-	-	-	-	-	-	-	-	-
		8/11/2018	-	-	-	-	-	-	-	-	-	-	-
		11/02/2019	0.87	< 0.0001	0.017	< 1	< 2	< 2	< 2	< 2	< 2	< 0.5	< 0.5

Table 1: **Groundwater Results**
Client: Wollongong City Council

EPA Destination	Sample ID	Sample Date	OCPs				OPPs						
			DDT	Endrin	g-BHC (Lindane)	Heptachlor	Azinophos methyl	Bromophos-ethyl	Carbophenothion	Chlorfenvinphos	Chlorpyrifos	Diazinon	Dichlorvos
			µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL			2	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
ANZECC 2000 Fresh Water (95%)			0.01	0.02	0.2	0.09	0.02				0.01	0.01	
Metals Hardness Modified Trigger Values		Very Hard (180-240 mg/L as $CaCO_3$)											
		Extremely Hard (>240 mg/L as $CaCO_3$)											
5	GABH02	22/05/2018	-	-	-	-	-	-	-	-	-	-	-
		14/08/2018	-	-	-	-	-	-	-	-	-	-	-
		8/11/2018	-	-	-	-	-	-	-	-	-	-	-
		11/02/2019	< 2	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
9	GMW102	22/05/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		14/08/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		8/11/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		11/02/2019	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
10	GMW103	22/05/2018	-	-	-	-	-	-	-	-	-	-	-
		14/08/2018	-	-	-	-	-	-	-	-	-	-	-
		8/11/2018	-	-	-	-	-	-	-	-	-	-	-
		11/02/2019	< 2	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
11	GMW104	22/05/2018	-	-	-	-	-	-	-	-	-	-	-
		14/08/2018	-	-	-	-	-	-	-	-	-	-	-
		8/11/2018	-	-	-	-	-	-	-	-	-	-	-
		11/02/2019	< 2	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
12	GMW105	22/05/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		14/08/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		8/11/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		11/02/2019	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
13	GMW106	22/05/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		14/08/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		8/11/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		11/02/2019	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
14	GMW108S	22/05/2018	-	-	-	-	-	-	-	-	-	-	-
		14/08/2018	-	-	-	-	-	-	-	-	-	-	-
		8/11/2018	-	-	-	-	-	-	-	-	-	-	-
		11/02/2019	< 2	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5

Table 1: **Groundwater Results**
Client: Wollongong City Council

EPA Destination	Sample ID	Sample Date	OCPs				OPPs						
			DDT	Endrin	g-BHC (Lindane)	Heptachlor	Azinophos methyl	Bromophos-ethyl	Carbophenothion	Chlorfenvinphos	Chlorpyrifos	Diazinon	Dichlorvos
			µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL			2	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
ANZECC 2000 Fresh Water (95%)			0.01	0.02	0.2	0.09	0.02				0.01	0.01	
Metals Hardness Modified Trigger Values		Very Hard (180-240 mg/L as $CaCO_3$)											
		Extremely Hard (>240 mg/L as $CaCO_3$)											
15	GMW108D	22/05/2018	-	-	-	-	-	-	-	-	-	-	-
		14/08/2018	-	-	-	-	-	-	-	-	-	-	-
		8/11/2018	-	-	-	-	-	-	-	-	-	-	-
		11/02/2019	< 2	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
16	GMW109S	22/05/2018	-	-	-	-	-	-	-	-	-	-	-
		14/08/2018	-	-	-	-	-	-	-	-	-	-	-
		8/11/2018	-	-	-	-	-	-	-	-	-	-	-
		11/02/2019	< 2	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
17	GMW110	22/05/2018	-	-	-	-	-	-	-	-	-	-	-
		14/08/2018	-	-	-	-	-	-	-	-	-	-	-
		8/11/2018	-	-	-	-	-	-	-	-	-	-	-
		11/02/2019	< 2	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
18	GMW111	22/05/2018	-	-	-	-	-	-	-	-	-	-	-
		14/08/2018	-	-	-	-	-	-	-	-	-	-	-
		8/11/2018	-	-	-	-	-	-	-	-	-	-	-
		11/02/2019	< 2	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
19	GMW109D	22/05/2018	-	-	-	-	-	-	-	-	-	-	-
		14/08/2018	-	-	-	-	-	-	-	-	-	-	-
		8/11/2018	-	-	-	-	-	-	-	-	-	-	-
		11/02/2019	< 2	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
20	BH6	22/05/2018	-	-	-	-	-	-	-	-	-	-	-
		14/08/2018	-	-	-	-	-	-	-	-	-	-	-
		8/11/2018	-	-	-	-	-	-	-	-	-	-	-
		11/02/2019	< 2	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5

Table 1: **Groundwater Results**
Client: Wollongong City Council

EPA Destination	Sample ID	Sample Date	Pesticides									PA	
			Dimethoate	Ethion	Fenthion	Malathion	Methyl parathion	Monocrotophos	Fenamiphos	Parathion	Pirimphos-ethyl	Anthracene	Benzo(a)pyrene
			µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL			0.5	0.5	0.5	0.5	2	2	0.5	2	0.5	1	0.5
ANZECC 2000 Fresh Water (95%)			0.15			0.05				0.004		0.4	
Metals Hardness Modified Trigger Values		Very Hard (180-240 mg/L as $CaCO_3$)											
		Extremely Hard (>240 mg/L as $CaCO_3$)											
5	GABH02	22/05/2018	-	-	-	-	-	-	-	-	-	-	-
		14/08/2018	-	-	-	-	-	-	-	-	-	-	-
		8/11/2018	-	-	-	-	-	-	-	-	-	-	-
		11/02/2019	< 0.5	< 0.5	< 0.5	< 0.5	< 2	< 2	< 0.5	< 2	< 0.5	< 1	< 0.5
9	GMW102	22/05/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		14/08/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		8/11/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		11/02/2019	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
10	GMW103	22/05/2018	-	-	-	-	-	-	-	-	-	-	-
		14/08/2018	-	-	-	-	-	-	-	-	-	-	-
		8/11/2018	-	-	-	-	-	-	-	-	-	-	-
		11/02/2019	< 0.5	< 0.5	< 0.5	< 0.5	< 2	< 2	< 0.5	< 2	< 0.5	< 1	< 0.5
11	GMW104	22/05/2018	-	-	-	-	-	-	-	-	-	-	-
		14/08/2018	-	-	-	-	-	-	-	-	-	-	-
		8/11/2018	-	-	-	-	-	-	-	-	-	-	-
		11/02/2019	< 0.5	< 0.5	< 0.5	< 0.5	< 2	< 2	< 0.5	< 2	< 0.5	< 1	< 0.5
12	GMW105	22/05/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		14/08/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		8/11/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		11/02/2019	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
13	GMW106	22/05/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		14/08/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		8/11/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		11/02/2019	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
14	GMW108S	22/05/2018	-	-	-	-	-	-	-	-	-	-	-
		14/08/2018	-	-	-	-	-	-	-	-	-	-	-
		8/11/2018	-	-	-	-	-	-	-	-	-	-	-
		11/02/2019	< 0.5	< 0.5	< 0.5	< 0.5	< 2	< 2	< 0.5	< 2	< 0.5	< 1	< 0.5

Table 1: **Groundwater Results**
Client: Wollongong City Council

EPA Destination	Sample ID	Sample Date							Pesticides			PAH	
			Dimethoate	Ethion	Fenthion	Malathion	Methyl parathion	Monocrotophos	Fenamiphos	Parathion	Pirimphos-ethyl	Anthracene	Benzo(a)pyrene
			µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL			0.5	0.5	0.5	0.5	2	2	0.5	2	0.5	1	0.5
ANZECC 2000 Fresh Water (95%)			0.15			0.05				0.004		0.4	
Metals Hardness Modified Trigger Values		Very Hard (180-240 mg/L as $CaCO_3$)											
		Extremely Hard (>240 mg/L as $CaCO_3$)											
15	GMW108D	22/05/2018	-	-	-	-	-	-	-	-	-	-	-
		14/08/2018	-	-	-	-	-	-	-	-	-	-	-
		8/11/2018	-	-	-	-	-	-	-	-	-	-	-
		11/02/2019	< 0.5	< 0.5	< 0.5	< 0.5	< 2	< 2	< 0.5	< 2	< 0.5	< 1	< 0.5
16	GMW109S	22/05/2018	-	-	-	-	-	-	-	-	-	-	-
		14/08/2018	-	-	-	-	-	-	-	-	-	-	-
		8/11/2018	-	-	-	-	-	-	-	-	-	-	-
		11/02/2019	< 0.5	< 0.5	< 0.5	< 0.5	< 2	< 2	< 0.5	< 2	< 0.5	< 1	< 0.5
17	GMW110	22/05/2018	-	-	-	-	-	-	-	-	-	-	-
		14/08/2018	-	-	-	-	-	-	-	-	-	-	-
		8/11/2018	-	-	-	-	-	-	-	-	-	-	-
		11/02/2019	< 0.5	< 0.5	< 0.5	< 0.5	< 2	< 2	< 0.5	< 2	< 0.5	< 1	< 0.5
18	GMW111	22/05/2018	-	-	-	-	-	-	-	-	-	-	-
		14/08/2018	-	-	-	-	-	-	-	-	-	-	-
		8/11/2018	-	-	-	-	-	-	-	-	-	-	-
		11/02/2019	< 0.5	< 0.5	< 0.5	< 0.5	< 2	< 2	< 0.5	< 2	< 0.5	< 1	< 0.5
19	GMW109D	22/05/2018	-	-	-	-	-	-	-	-	-	-	-
		14/08/2018	-	-	-	-	-	-	-	-	-	-	-
		8/11/2018	-	-	-	-	-	-	-	-	-	-	-
		11/02/2019	< 0.5	< 0.5	< 0.5	< 0.5	< 2	< 2	< 0.5	< 2	< 0.5	< 1	< 0.5
20	BH6	22/05/2018	-	-	-	-	-	-	-	-	-	-	-
		14/08/2018	-	-	-	-	-	-	-	-	-	-	-
		8/11/2018	-	-	-	-	-	-	-	-	-	-	-
		11/02/2019	< 0.5	< 0.5	< 0.5	< 0.5	< 2	< 2	< 0.5	< 2	< 0.5	< 1	< 0.5

Table 1: **Groundwater Results**
Client: Wollongong City Council

EPA Destination	Sample ID	Sample Date	PAH		Hydrocarbons		Inorganics						
			Naphthalene	PAH Total	Total Phenolics	Total Petroleum Hydrocarbons	Alkalinity (as Calcium Carbonate)	Calcium	Magnesium	Potassium	Sodium	Chloride	Fluoride
			µg/L	µg/L	mg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL			1	1	0.05	50	1	1	1	1	1	1	0.1
ANZECC 2000 Fresh Water (95%)			16		0.32								
Metals Hardness Modified Trigger Values		Very Hard (180-240 mg/L as $CaCO_3$)											
		Extremely Hard (>240 mg/L as $CaCO_3$)											
5	GABH02	22/05/2018	-	-	-	-	1210	304	196	3	619	1140	-
		14/08/2018	-	-	-	-	1100	295	181	2	583	1180	-
		8/11/2018	-	-	-	-	983	303	196	2	645	1270	-
		11/02/2019	< 1	< 1	< 0.05	< 50	1130	310	188	3	584	1220	0.6
9	GMW102	22/05/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		14/08/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		8/11/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		11/02/2019	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
10	GMW103	22/05/2018	-	-	-	-	438	190	65	1	172	455	-
		14/08/2018	-	-	-	-	430	194	63	< 1	162	482	-
		8/11/2018	-	-	-	-	372	172	58	< 1	165	372	-
		11/02/2019	< 1	< 1	< 0.05	< 50	462	164	0.141	-	163	305	0.4
11	GMW104	22/05/2018	-	-	-	-	500	62	42.0	1	180	122	-
		14/08/2018	-	-	-	-	481	63	38	< 1	162	120	-
		8/11/2018	-	-	-	-	372	172	58	< 1	165	372	-
		11/02/2019	< 1	< 1	< 0.05	< 50	468	73	46	-	167	113	0.8
12	GMW105	22/05/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		14/08/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		8/11/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		11/02/2019	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
13	GMW106	22/05/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		14/08/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		8/11/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		11/02/2019	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
14	GMW108S	22/05/2018	-	-	-	-	434	94	67	2	298	496	-
		14/08/2018	-	-	-	-	447	112	75	2	313	577	-
		8/11/2018	-	-	-	-	319	88	52	5	211	331	-
		11/02/2019	< 1	< 1	< 0.05	< 50	379	89	54	6	203	350	0.4

Table 1: **Groundwater Results**
Client: Wollongong City Council

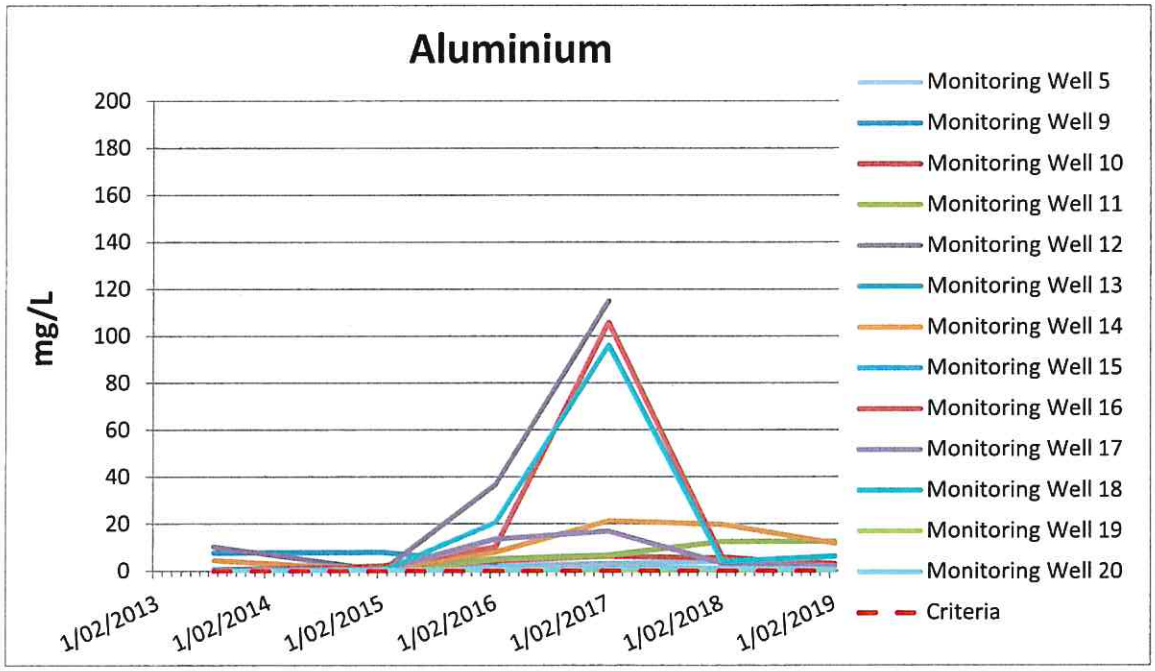
EPA Destination	Sample ID	Sample Date	PAH		Hydrocarbons		Inorganics						
			Naphthalene	PAH Total	Total Phenolics	Total Petroleum Hydrocarbons	Alkalinity (as Calcium Carbonate)	Calcium	Magnesium	Potassium	Sodium	Chloride	Fluoride
			µg/L	µg/L	mg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL			1	1	0.05	50	1	1	1	1	1	1	0.1
ANZECC 2000 Fresh Water (95%)			16		0.32								
Metals Hardness Modified Trigger Values		Very Hard (180-240 mg/L as $CaCO_3$)											
		Extremely Hard (>240 mg/L as $CaCO_3$)											
15	GMW108D	22/05/2018	-	-	-	-	505	130	88	1	431	706	-
		14/08/2018	-	-	-	-	470	128	82	2	405	673	-
		8/11/2018	-	-	-	-	424	130	86	1	416	739	-
		11/02/2019	< 1	< 1	< 0.05	< 50	490	129	88	<1	408	729	0.7
16	GMW109S	22/05/2018	-	-	-	-	266	66	41	2	142	288	-
		14/08/2018	-	-	-	-	211	77	49	2	157	368	-
		8/11/2018	-	-	-	-	254	78	51	2	168	353	-
		11/02/2019	< 1	< 1	0.05	< 50	223	28	18	1	61	299	< 0.1
17	GMW110	22/05/2018	-	-	-	-	624	207	159	1	460	988	-
		14/08/2018	-	-	-	-	610	204	153	1	454	1910	-
		8/11/2018	-	-	-	-	506	208	162	2	480	1050	-
		11/02/2019	< 1	< 1	< 0.05	< 50	618	211	160	2	466	996	0.5
18	GMW111	22/05/2018	-	-	-	-	558	126	104	1	433	739	-
		14/08/2018	-	-	-	-	610	126	99	1	420	800	-
		8/11/2018	-	-	-	-	466	114	93	< 1	418	708	-
		11/02/2019	< 1	< 1	< 0.05	< 50	560	125	99	< 1	409	700	0.5
19	GMW109D	22/05/2018	-	-	-	-	424	89	48	1	185	480	-
		14/08/2018	-	-	-	-	234	92	48	1	186	359	-
		8/11/2018	-	-	-	-	207	98	49	1	190	492	-
		11/02/2019	< 1	< 1	< 0.05	< 50	233	95	50	1	188	485	0.4
20	BH6	22/05/2018	-	-	-	-	799	121	130	1	792	1200	-
		14/08/2018	-	-	-	-	728	118	119	< 1	747	1120	-
		8/11/2018	-	-	-	-	650	118	65	4	312	361	-
		11/02/2019	< 1	< 1	< 0.05	< 50	426	101	33	9	119	66	0.6

Table 1: **Groundwater Results**
Client: Wollongong City Council

EPA Destination	Sample ID	Sample Date					Physical Characteristics			
			Sulfate	Nitrate	Nitrite	Nitrogen (Ammonia)	Total Dissolved Solids	Total Organic Carbon	pH	Electrical Conductivity
			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pH	µS/cm
EQL			1	0.01	0.01	0.01	1	1	0.01	1
ANZECC 2000 Fresh Water (95%)				7.2		0.9				
Metals Hardness Modified Trigger Values		Very Hard (180-240 mg/L as $CaCO_3$)								
		Extremely Hard (>240 mg/L as $CaCO_3$)								
5	GABH02	22/05/2018	-	-	-	0.04	3490	8	6.5	5330
		14/08/2018	166	-	-	0.02	2830	6	6.8	5420
		8/11/2018	163	-	-	0.02	3380	2	6.6	5490
		11/02/2019	174	< 0.01	< 0.01	0.04	2870	8	6.6	5430
9	GMW102	22/05/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		14/08/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		8/11/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		11/02/2019	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
10	GMW103	22/05/2018	151	-	-	0.03	1400	2	7	2250
		14/08/2018	139	-	-	0.06	1280	2	7.1	2160
		8/11/2018	136	-	-	0.04	1230	2	7.2	1970
		11/02/2019	76	0.26	< 0.01	0.03	978	1	7.1	1820
11	GMW104	22/05/2018	76	-	-	0.04	765	2	7.2	1340
		14/08/2018	65	-	-	0.03	774	2	7.4	1360
		8/11/2018	136	-	-	0.04	1230	2	7.2	1970
		11/02/2019	67	0.03	< 0.01	0.03	-	3	7.2	1260
12	GMW105	22/05/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		14/08/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		8/11/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		11/02/2019	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
13	GMW106	22/05/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		14/08/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		8/11/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		11/02/2019	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
14	GMW108S	22/05/2018	142	-	-	0.10	1280	8	6.8	2320
		14/08/2018	165	-	-	0.16	1380	4	7	2770
		8/11/2018	107	-	-	0.08	1610	5	7	1790
		11/02/2019	99	< 0.01	< 0.01	0.12	982	12	6.9	1800

Table 1: **Groundwater Results**
Client: Wollongong City Council

EPA Destination	Sample ID	Sample Date					Physical Characteristics			
			Sulfate	Nitrate	Nitrite	Nitrogen (Ammonia)	Total Dissolved Solids	Total Organic Carbon	pH	Electrical Conductivity
EQL			mg/L 1	mg/L 0.01	mg/L 0.01	mg/L 0.01	mg/L 1	mg/L 1	pH 0.01	µS/cm 1
ANZECC 2000 Fresh Water (95%)				7.2		0.9				
Metals Hardness Modified Trigger Values		Very Hard (180-240 mg/L as $CaCO_3$)								
		Extremely Hard (>240 mg/L as $CaCO_3$)								
15	GMW108D	22/05/2018	199	-	-	0.06	1590	2	6.8	3120
		14/08/2018	189	-	-	0.02	1670	3	7	3160
		8/11/2018	199	-	-	0.34	1870	< 1	6.8	3250
		11/02/2019	197	0.01	< 0.01	0.03	1810	2	6.9	3170
16	GMW109S	22/05/2018	95	-	-	0.81	757	6	6.4	1460
		14/08/2018	95	-	-	0.55	886	5	6.2	1630
		8/11/2018	115	-	-	0.34	974	< 1	6.3	1590
		11/02/2019	109	< 0.01	< 0.01	0.38	814	8	6.3	1460
17	GMW110	22/05/2018	338	-	-	0.01	2690	2	6.7	4370
		14/08/2018	324	-	-	0.02	2460	2	6.8	4370
		8/11/2018	329	-	-	0.02	2820	< 1	6.9	4340
		11/02/2019	286	0.57	< 0.01	0.02	2350	7	6.8	4380
18	GMW111	22/05/2018	205	-	-	0.02	1750	1	7.0	3390
		14/08/2018	217	-	-	0.02	1930	1	7	3490
		8/11/2018	180	-	-	0.02	1920	< 1	7.1	3210
		11/02/2019	108	0.01	< 0.01	0.03	1650	2	6.8	3230
19	GMW109D	22/05/2018	26	-	-	0.05	1000	1	6.9	1830
		14/08/2018	25	-	-	0.09	1040	< 1	6.9	1820
		8/11/2018	23	-	-	0.11	1260	< 1	6.9	1830
		11/02/2019	24	0.71	< 0.01	0.03	994	< 1	6.9	1840
20	BH6	22/05/2018	-	-	-	0.24	2960	9	6.9	5050
		14/08/2018	270	-	-	0.2	2520	6	6.9	5060
		8/11/2018	315	-	-	0.44	1560	31	7	2440
		11/02/2019	117	0.02	0.02	0.28	744	28	7	1180


Aluminium
mg/L
200
180
160
140
120
100
80
60
40
20
0
1/02/2013
1/02/2014
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1/02/2016
1/02/2017
1/02/2018
1/02/2019
Monitoring Well 5
Monitoring Well 9
Monitoring Well 10
Monitoring Well 11
Monitoring Well 12
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Monitoring Well 14
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Monitoring Well 16
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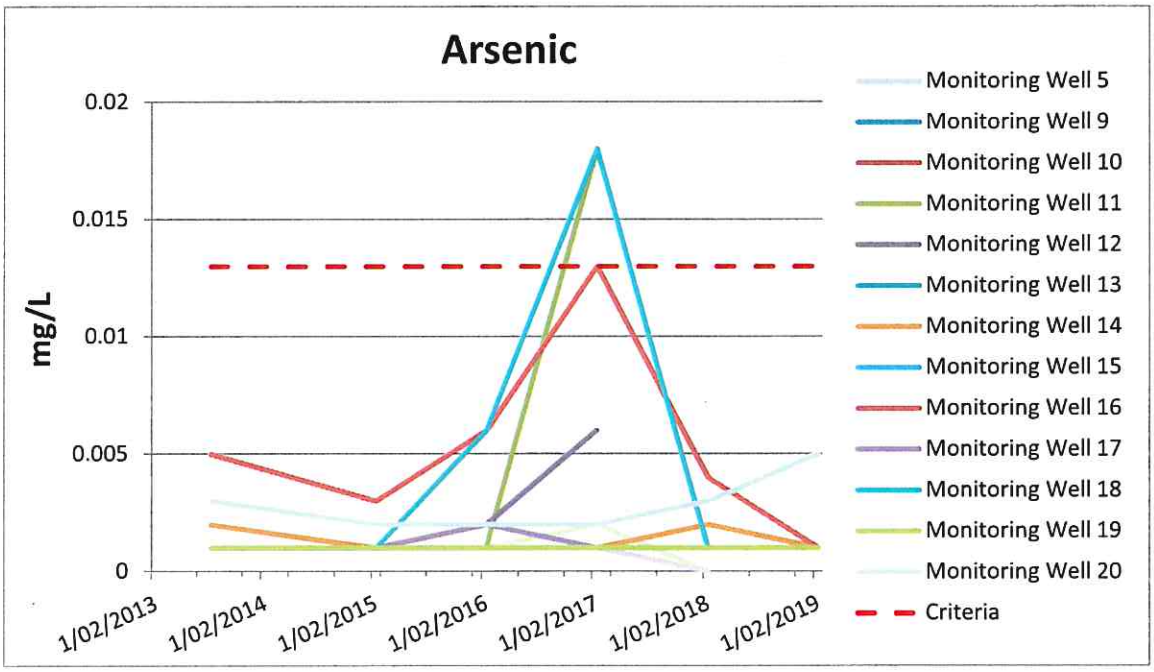
Monitoring Well 18
Monitoring Well 19
Monitoring Well 20
Criteria


Arsenic
mg/L
0.02
0.015
0.01
0.005
0
1/02/2013
1/02/2014
1/02/2015
1/02/2016
1/02/2017
1/02/2018
1/02/2019
Monitoring Well 5
Monitoring Well 9
Monitoring Well 10
Monitoring Well 11
Monitoring Well 12
Monitoring Well 13
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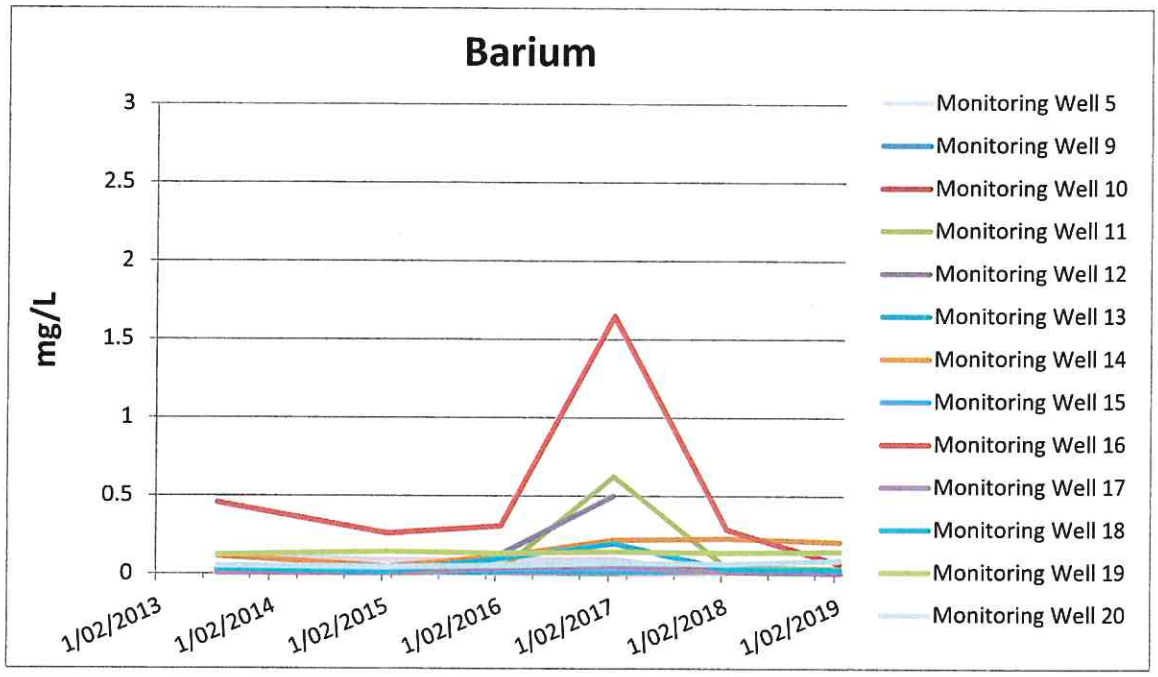
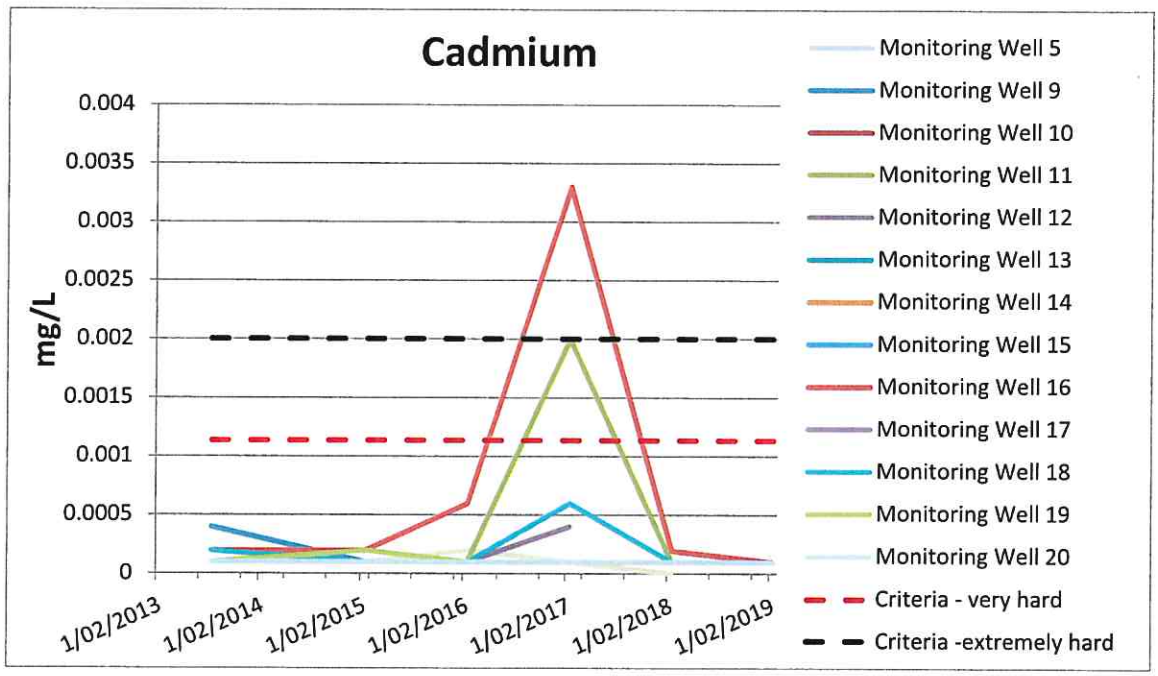
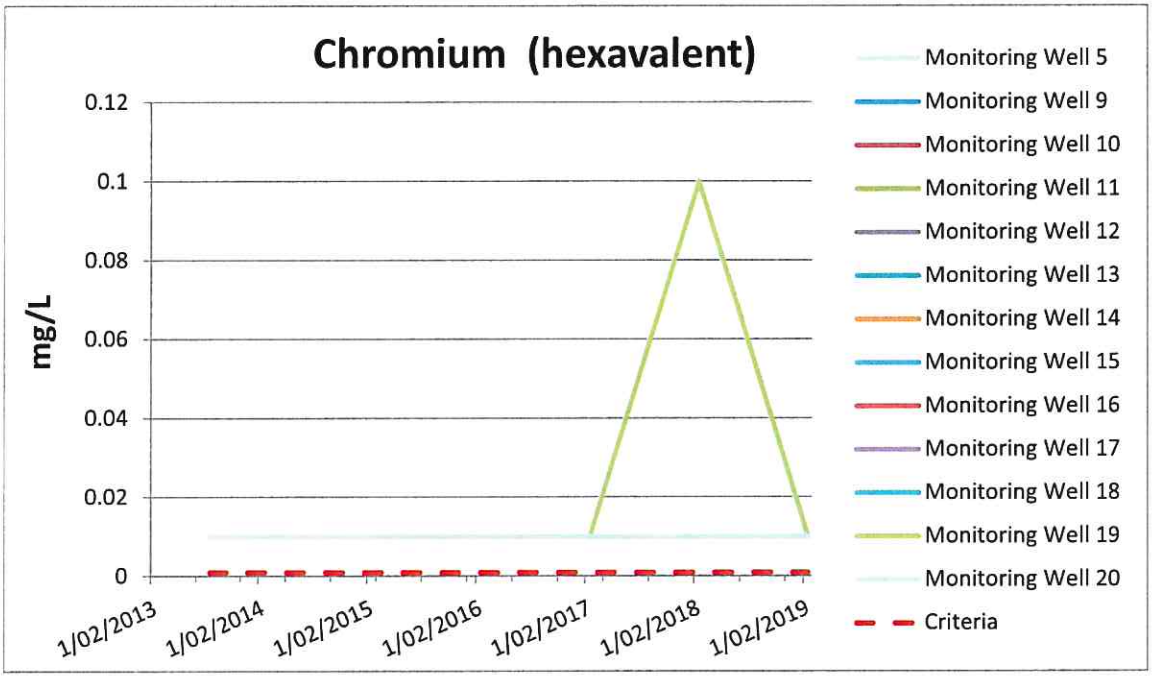
Monitoring Well 15
Monitoring Well 16
Monitoring Well 17
Monitoring Well 18
Monitoring Well 19
Monitoring Well 20
Criteria

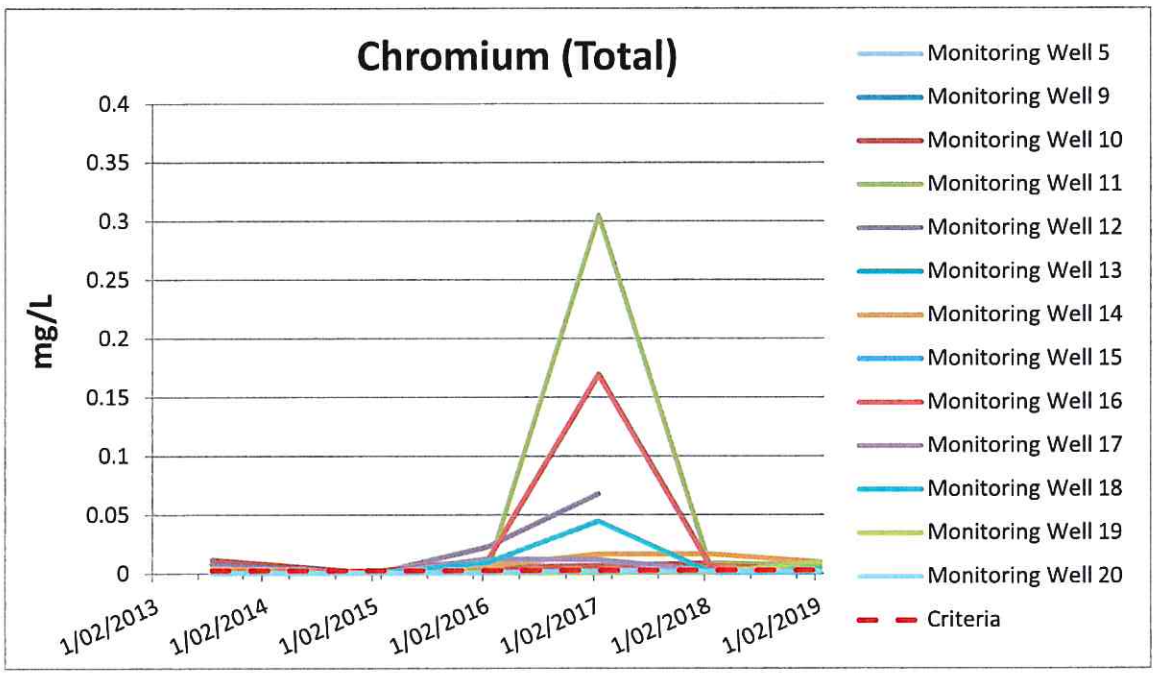
Whytes Gully Groundwater

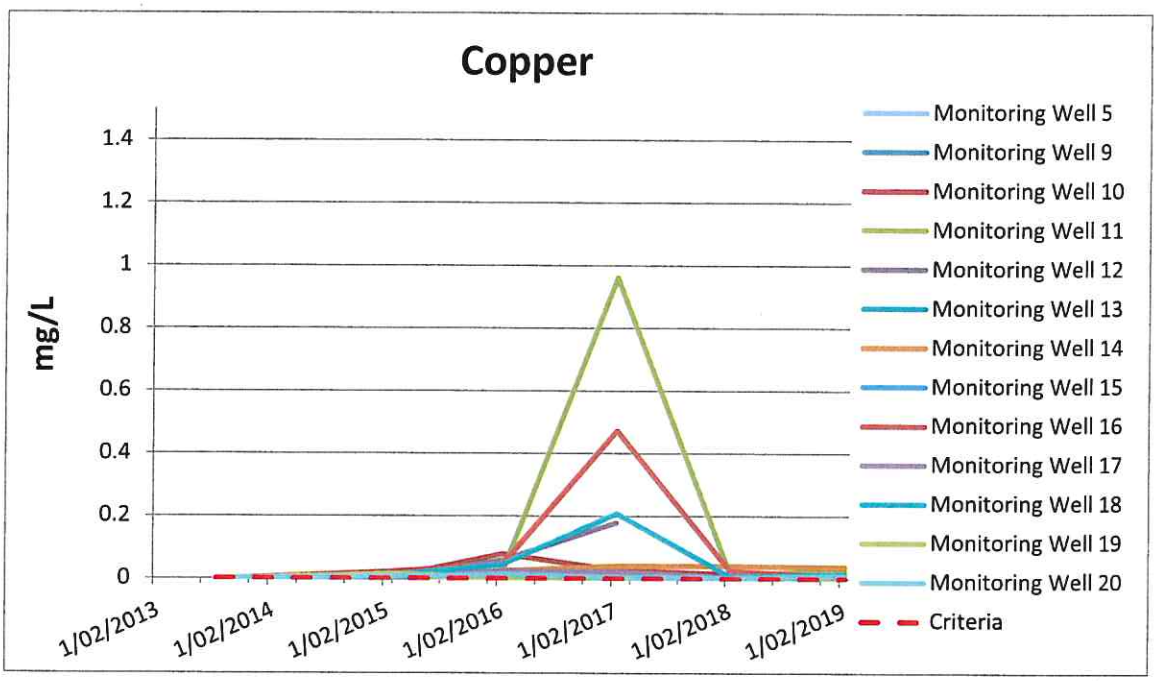




Whytes Gully Groundwater






Copper
mg/L
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1/02/2013
1/02/2014
1/02/2015
1/02/2016
1/02/2017
1/02/2018
1/02/2019
Monitoring Well 5
Monitoring Well 9
Monitoring Well 10
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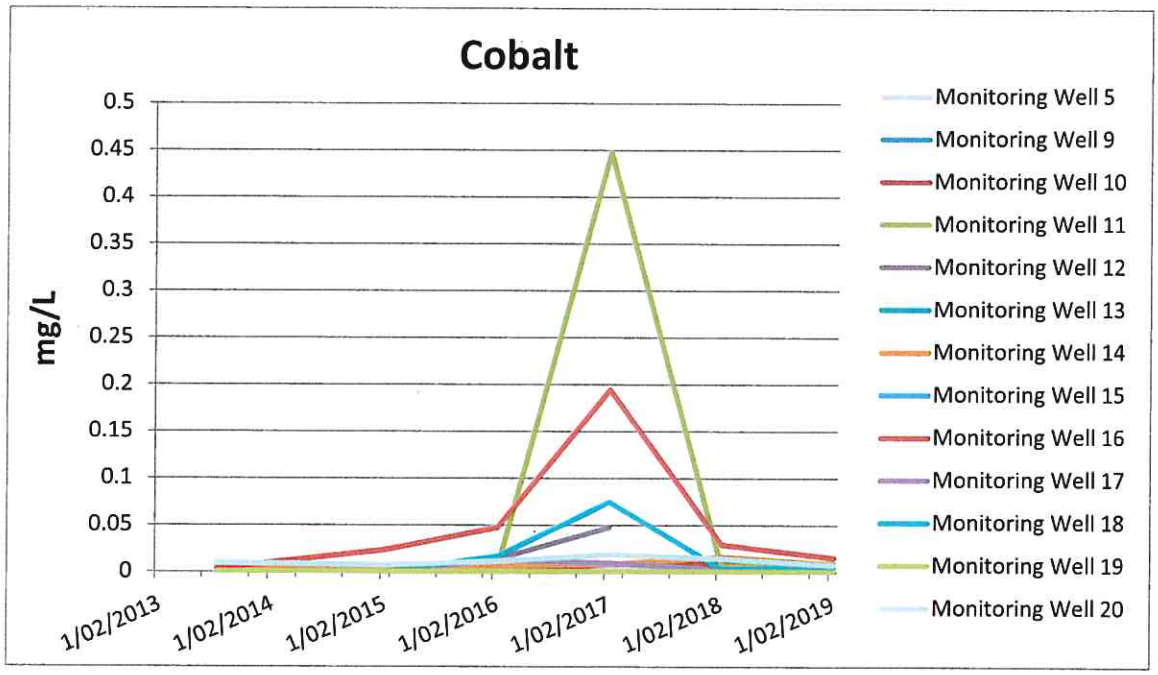
Monitoring Well 18
Monitoring Well 19
Monitoring Well 20
Criteria


Cobalt
mg/L
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
1/02/2013
1/02/2014
1/02/2015
1/02/2016
1/02/2017
1/02/2018
1/02/2019
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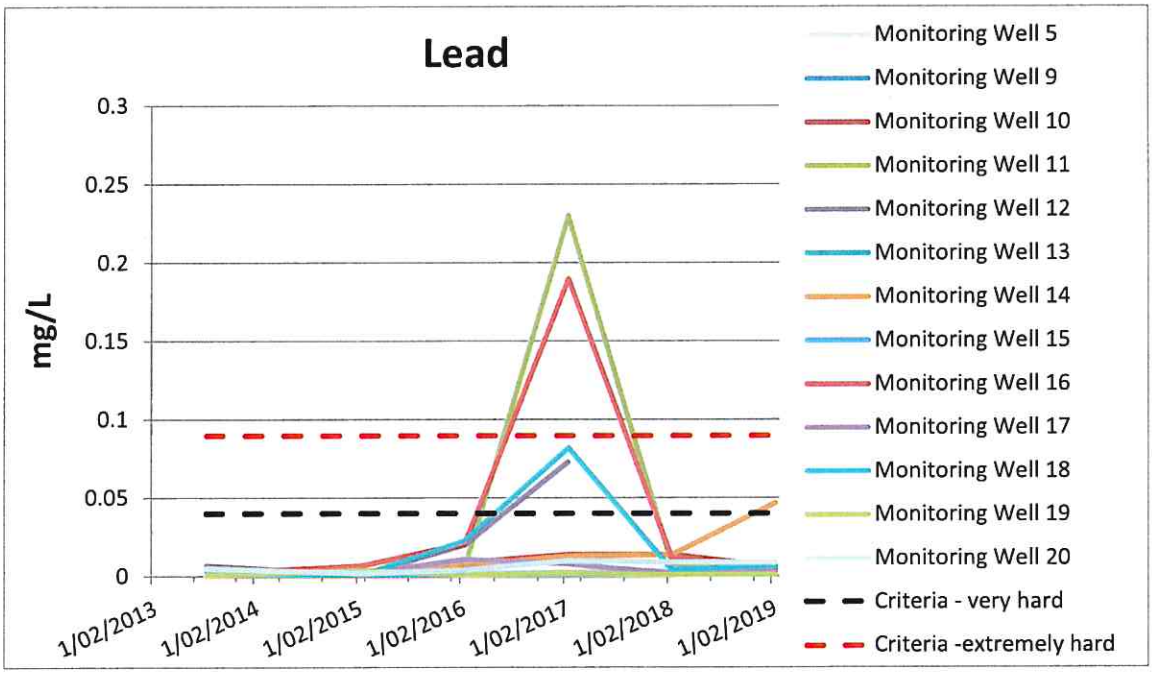
Monitoring Well 19
Monitoring Well 20


Lead
mg/L
0.3
0.25
0.2
0.15
0.1
0.05
0
1/02/2013
1/02/2014
1/02/2015
1/02/2016
1/02/2017
1/02/2018
1/02/2019
Monitoring Well 5
Monitoring Well 9
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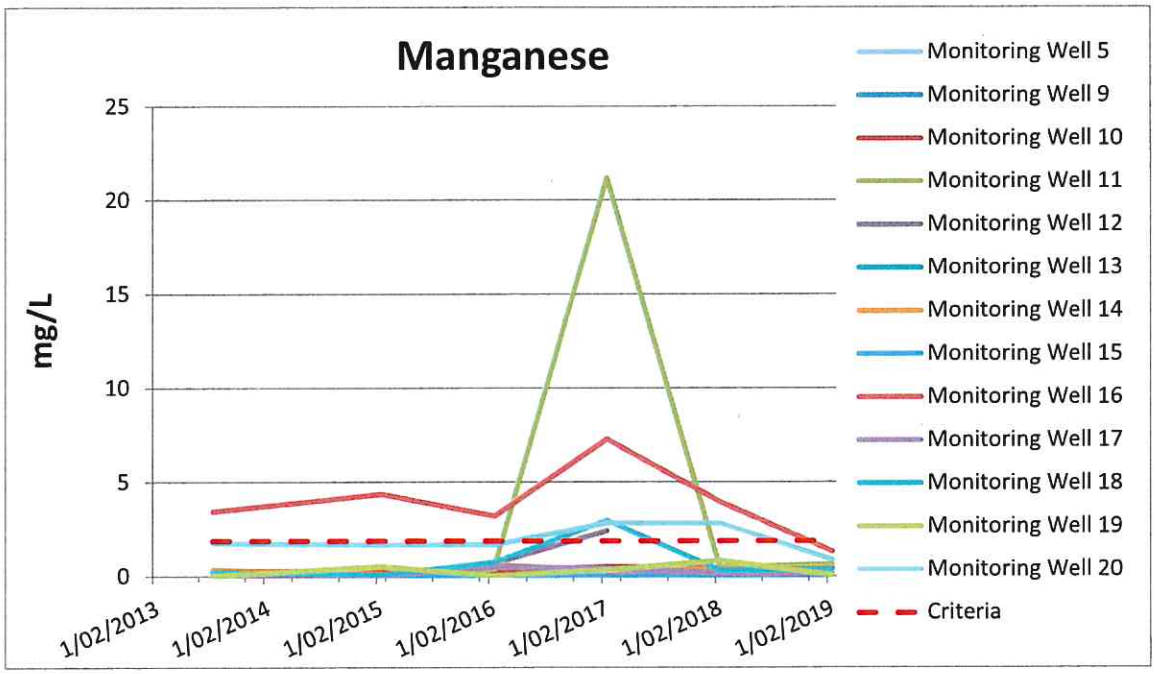
Monitoring Well 20
Criteria - very hard
Criteria -extremely hard


Manganese
mg/L
25
20
15
10
5
0
1/02/2013
1/02/2014
1/02/2015
1/02/2016
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1/02/2018
1/02/2019
Monitoring Well 5
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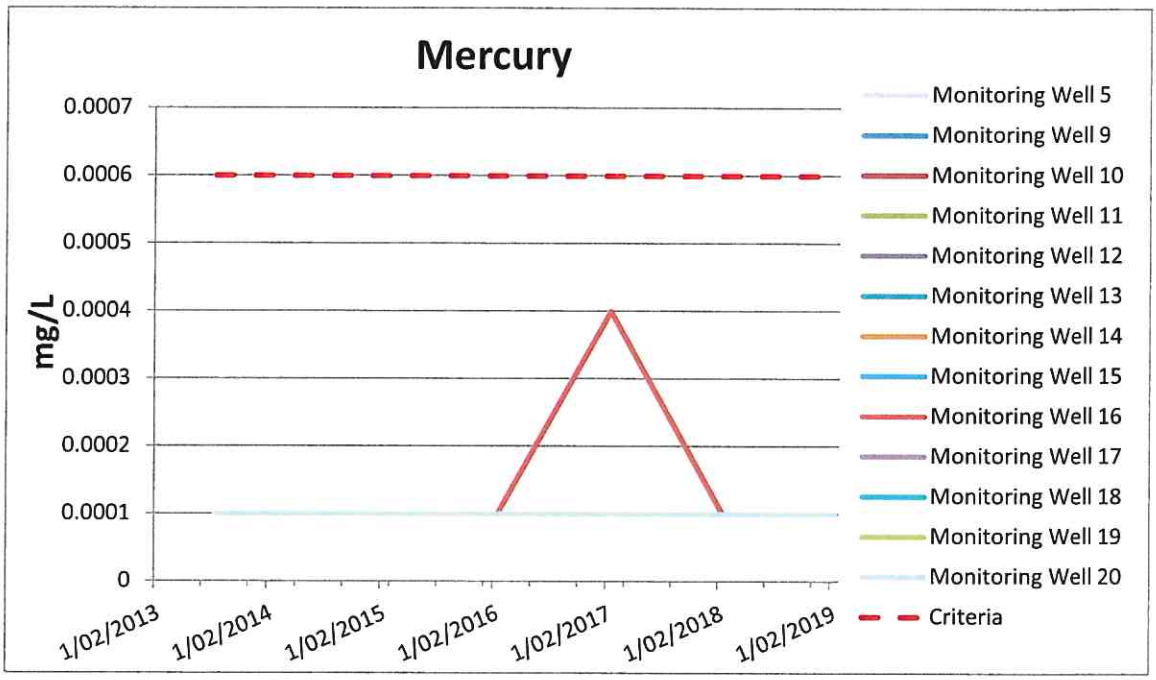
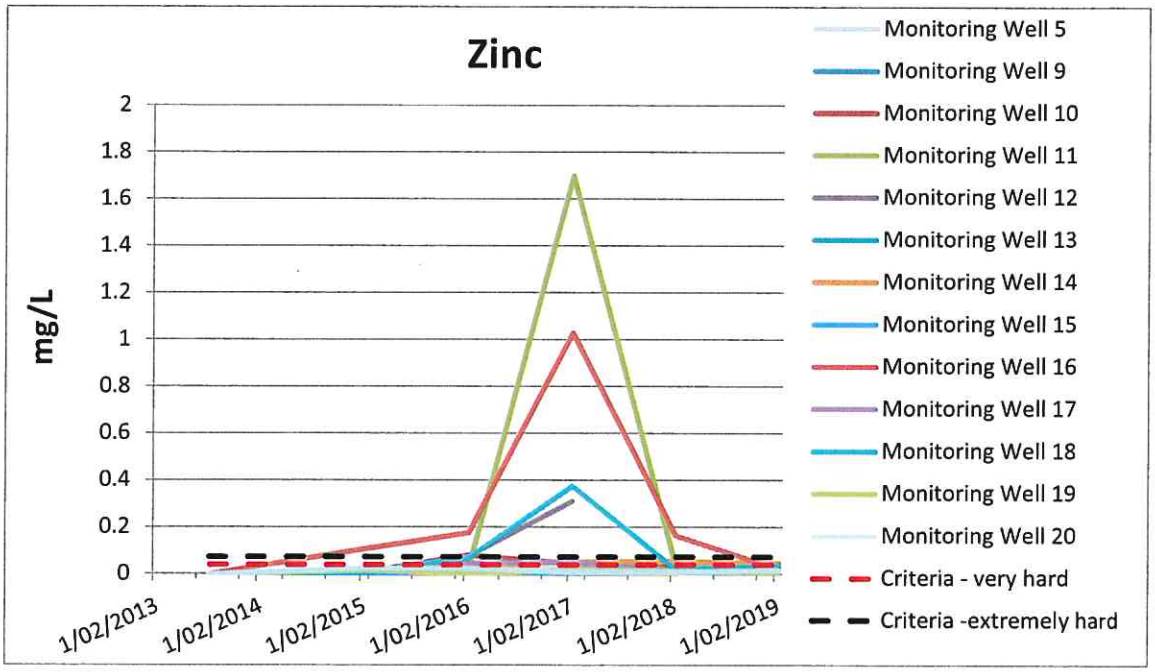
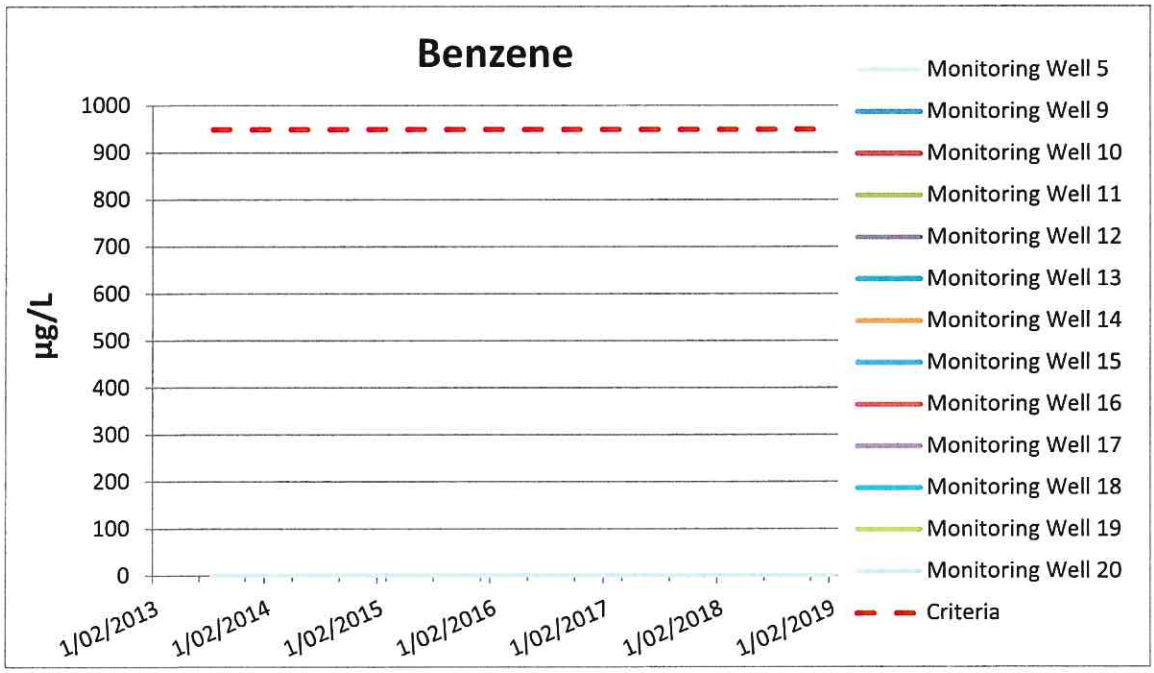
Monitoring Well 19
Monitoring Well 20
Criteria

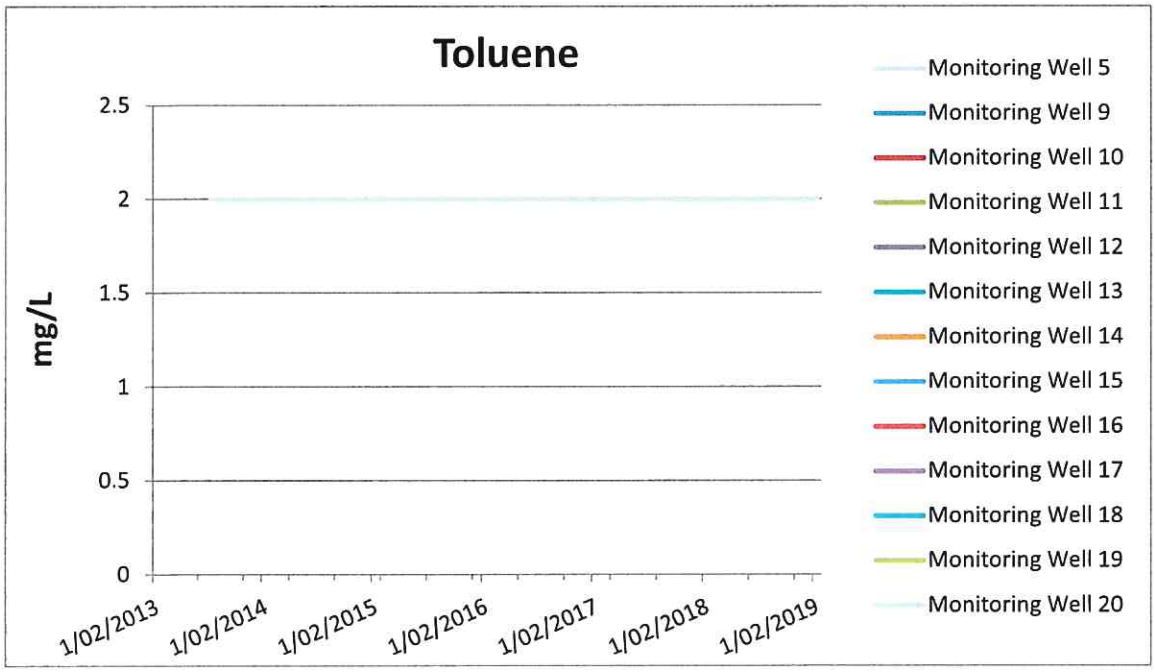
Whytes Gully Groundwater

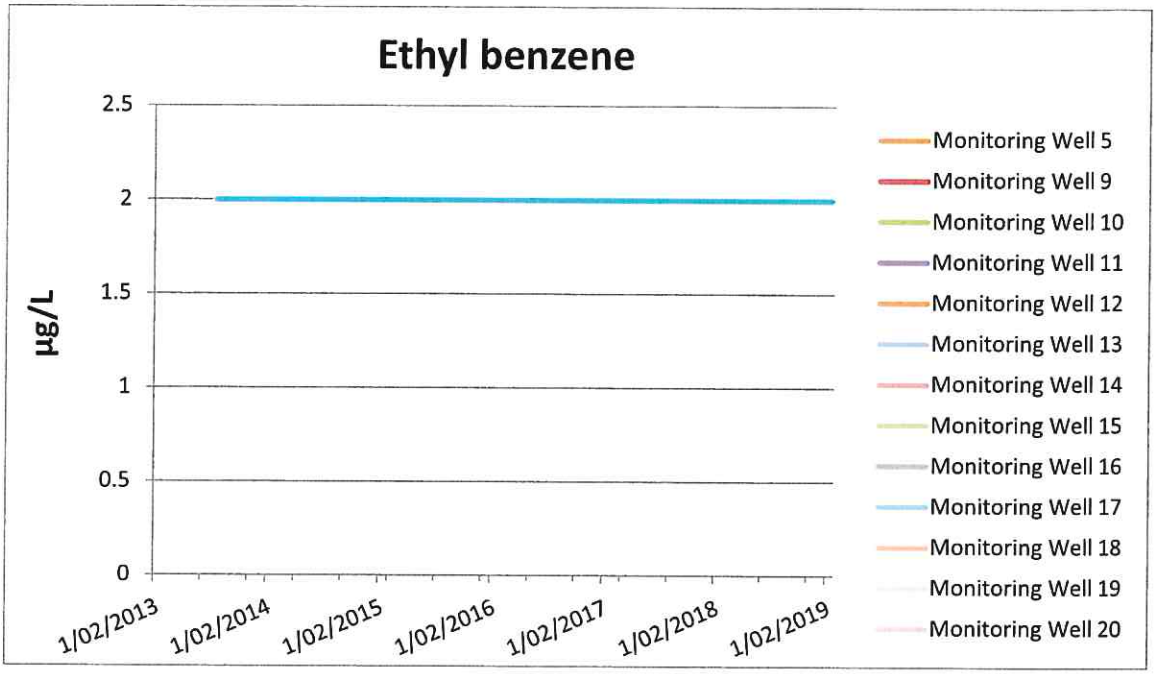




Whytes Gully Groundwater



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µg/L
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2
1.5
1
0.5
0
1/02/2013
1/02/2014
1/02/2015
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1/02/2017
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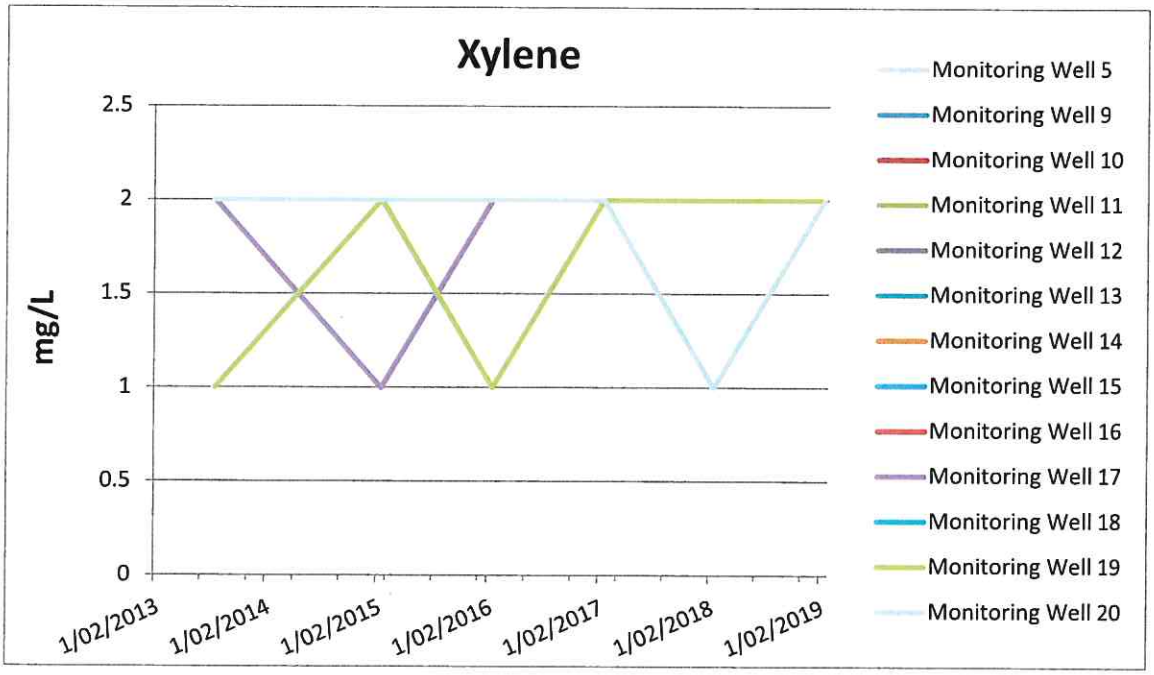
Monitoring Well 20


Xylene
mg/L
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2
1.5
1
0.5
0
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1/02/2014
1/02/2015
1/02/2016
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1/02/2019
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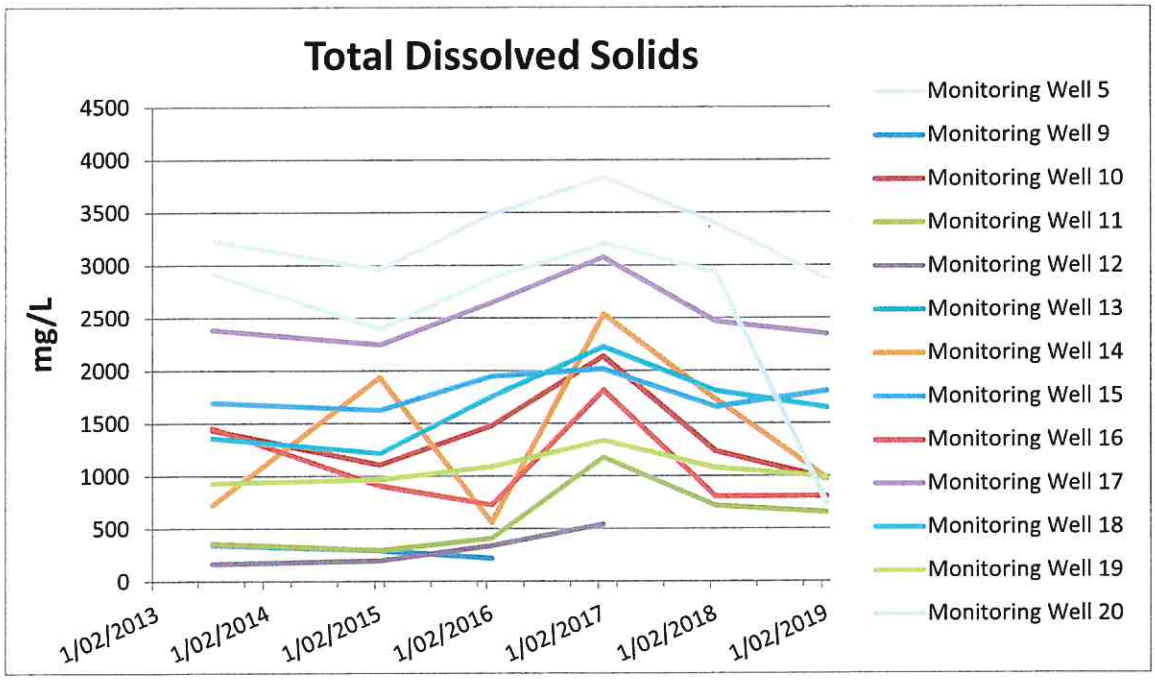
Monitoring Well 20


Total Dissolved Solids
mg/L
4500
4000
3500
3000
2500
2000
1500
1000
500
0
1/02/2013
1/02/2014
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1/02/2016
1/02/2017
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Monitoring Well 11
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Monitoring Well 13
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Monitoring Well 15
Monitoring Well 16
Monitoring Well 17
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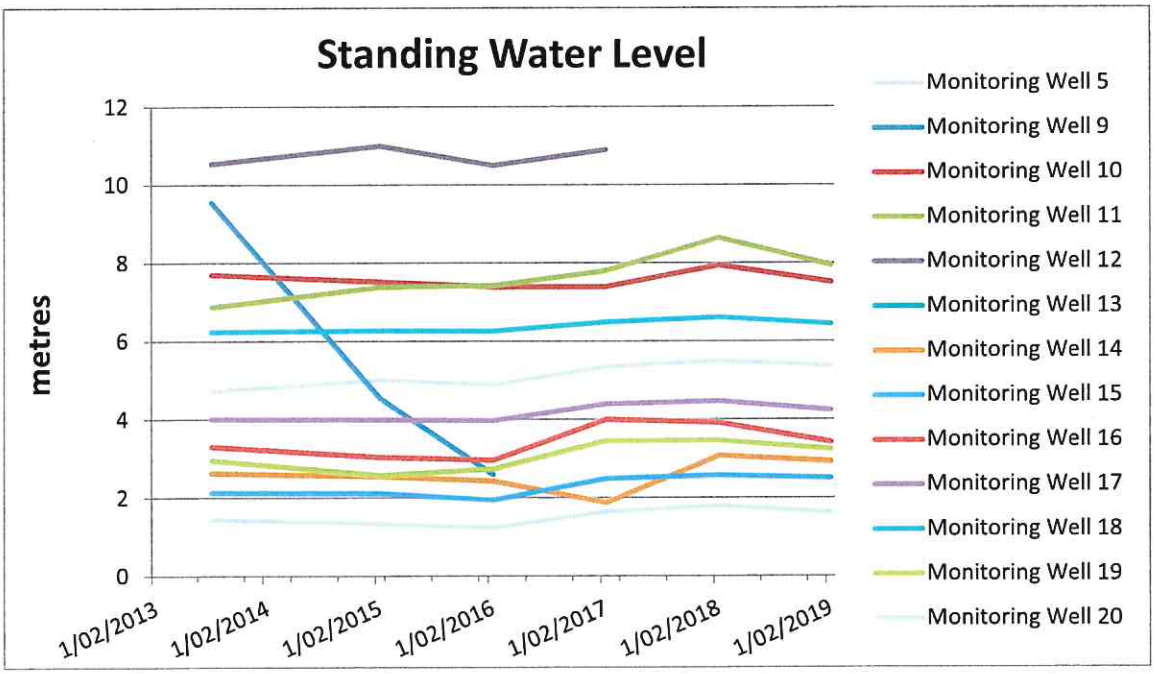
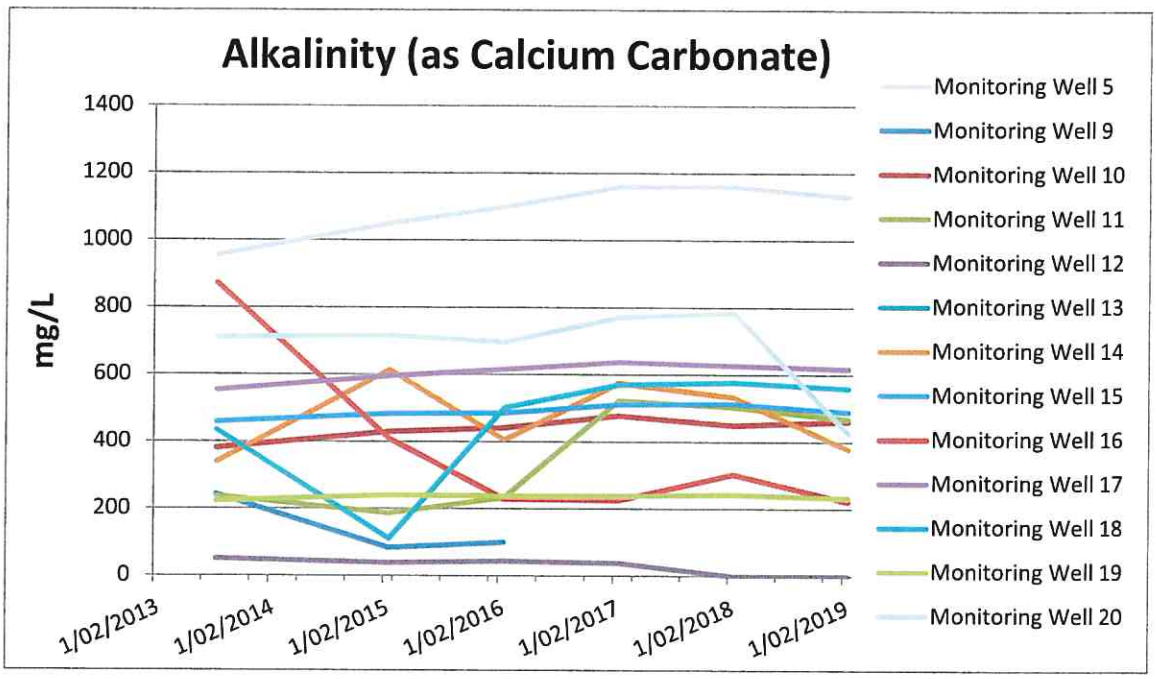
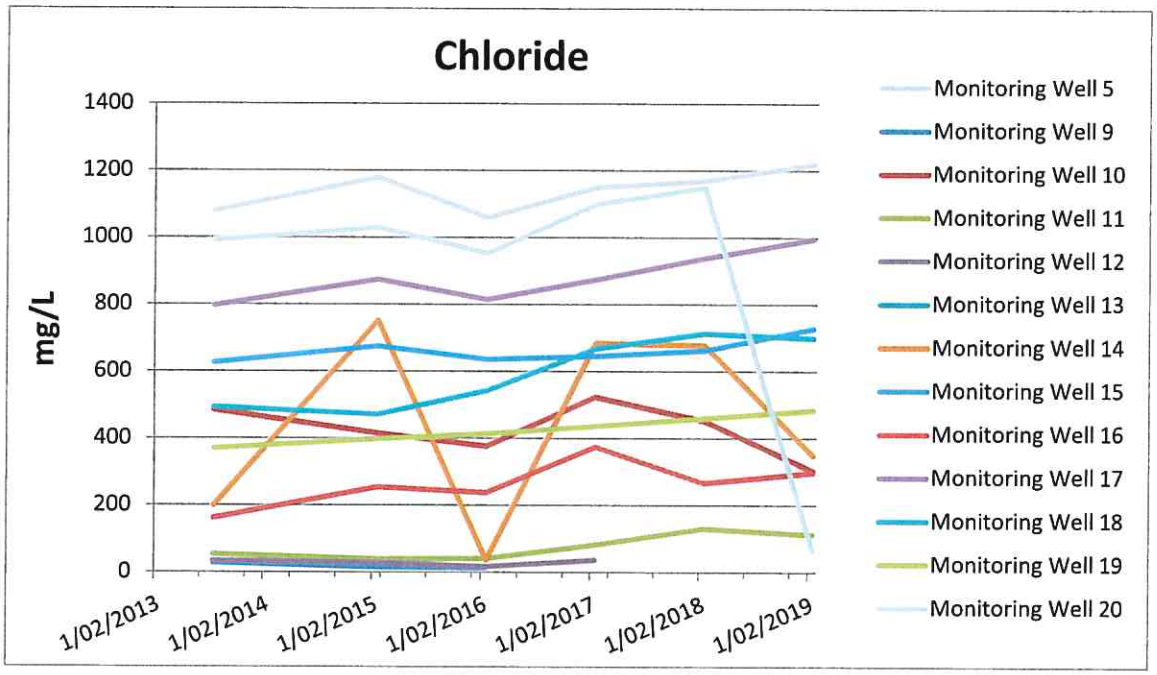
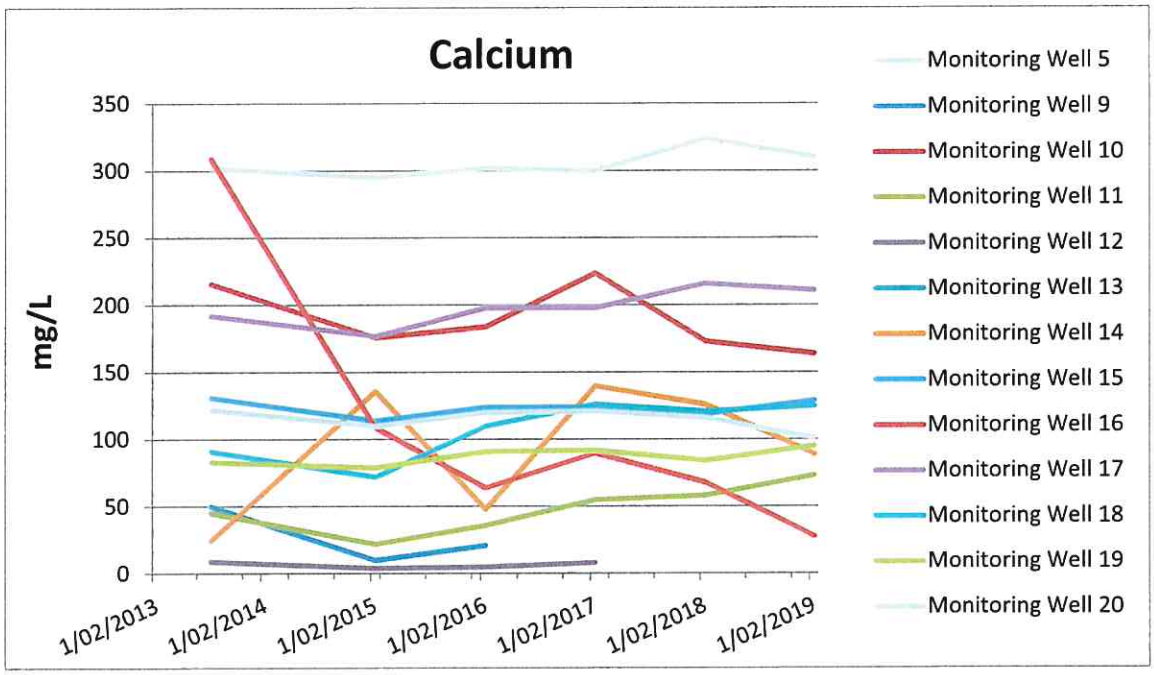
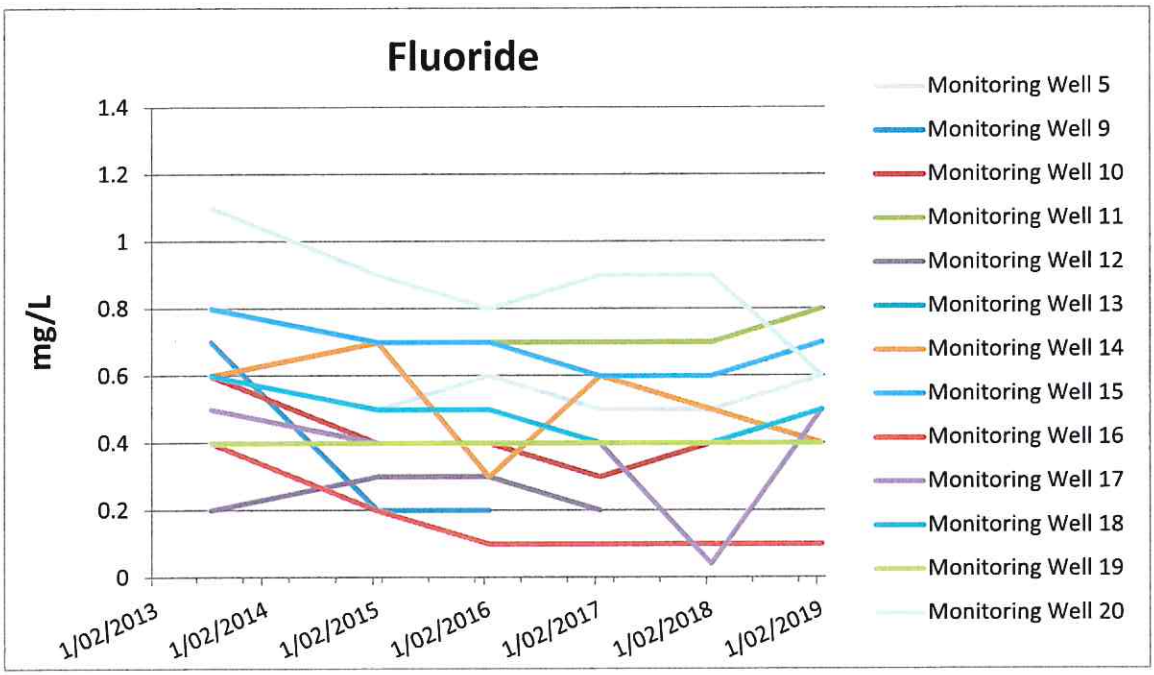
Monitoring Well 19
Monitoring Well 20

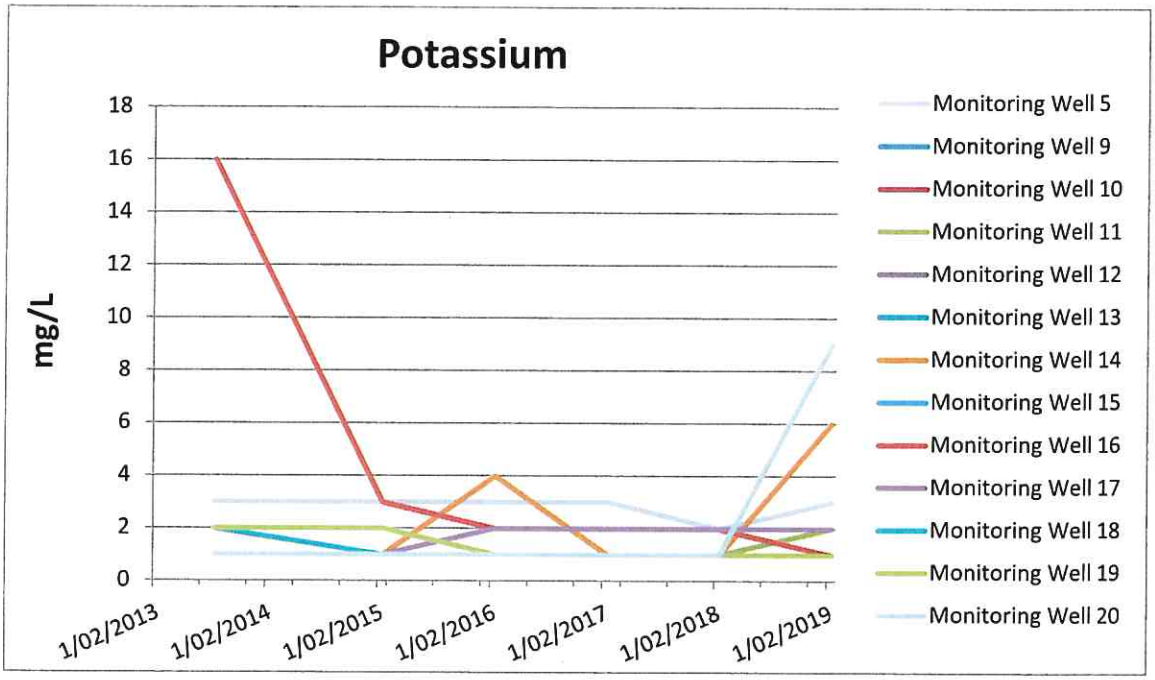

Standing Water Level
metres
12
10
8
6
4
2
0
1/02/2013
1/02/2014
1/02/2015
1/02/2016
1/02/2017
1/02/2018
1/02/2019
Monitoring Well 5
Monitoring Well 9
Monitoring Well 10
Monitoring Well 11
Monitoring Well 12
Monitoring Well 13
Monitoring Well 14
Monitoring Well 15
Monitoring Well 16
Monitoring Well 17
Monitoring Well 18
Monitoring Well 19
Monitoring Well 20

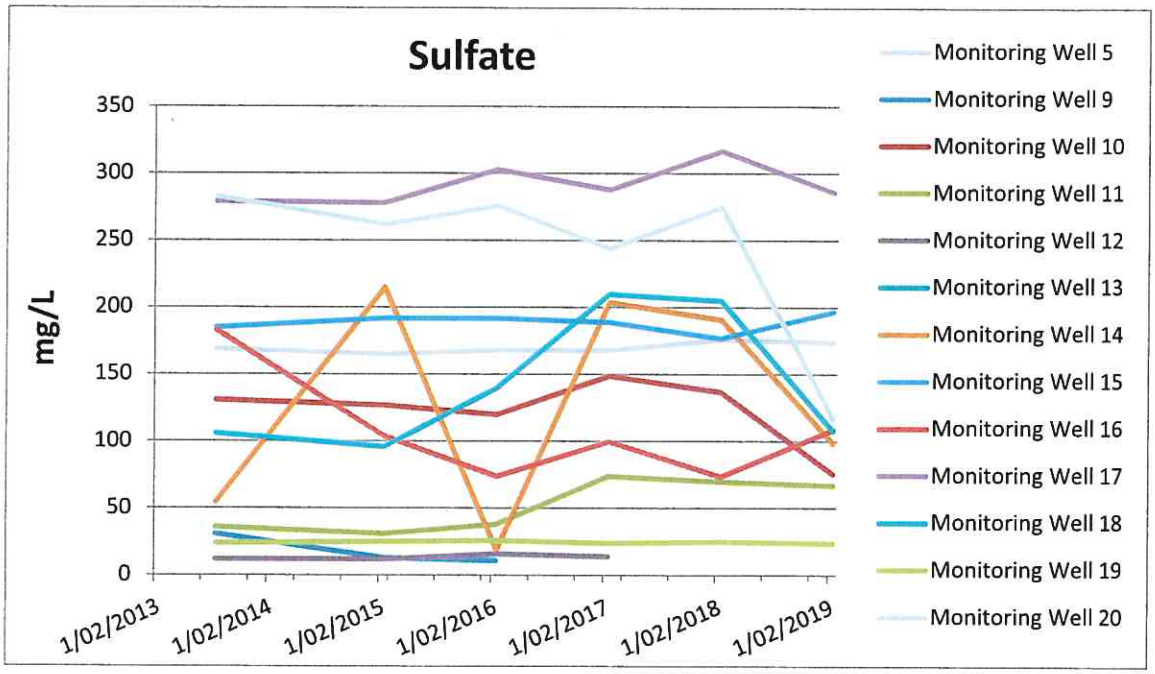

Alkalinity (as Calcium Carbonate)
mg/L
1400
1200
1000
800
600
400
200
0
1/02/2013
1/02/2014
1/02/2015
1/02/2016
1/02/2017
1/02/2018
1/02/2019
Monitoring Well 5
Monitoring Well 9
Monitoring Well 10
Monitoring Well 11
Monitoring Well 12
Monitoring Well 13
Monitoring Well 14
Monitoring Well 15
Monitoring Well 16
Monitoring Well 17
Monitoring Well 18
Monitoring Well 19
Monitoring Well 20

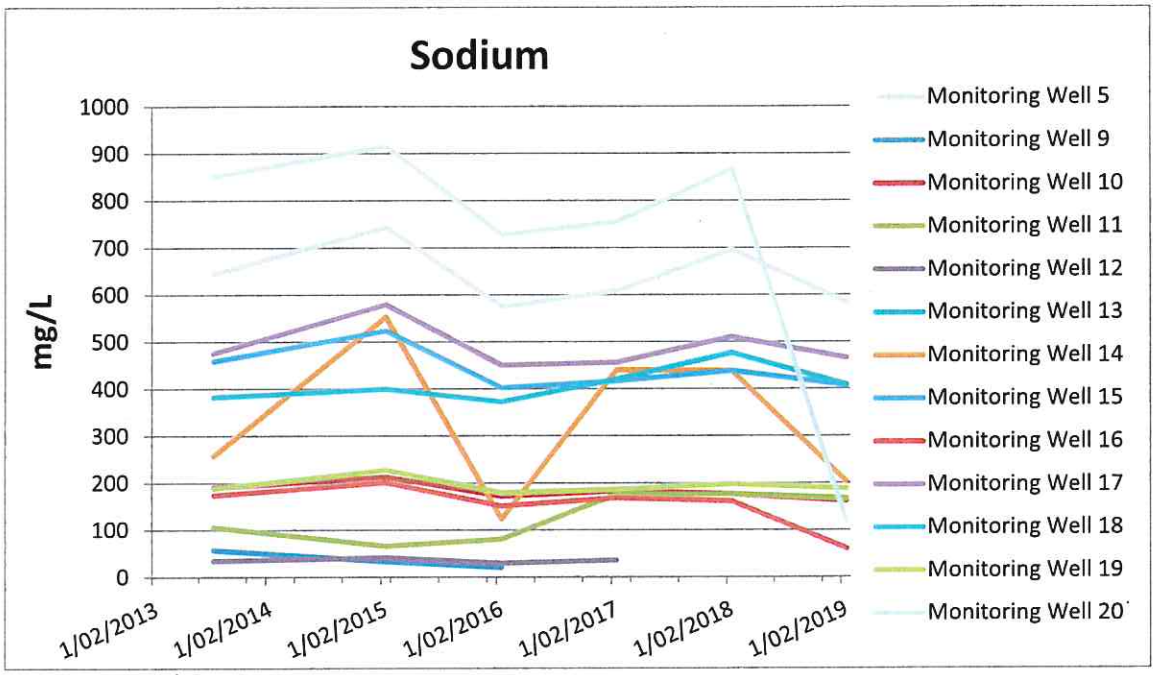

Chloride
mg/L
1400
1200
1000
800
600
400
200
0
1/02/2013
1/02/2014
1/02/2015
1/02/2016
1/02/2017
1/02/2018
1/02/2019
Monitoring Well 5
Monitoring Well 9
Monitoring Well 10
Monitoring Well 11
Monitoring Well 12
Monitoring Well 13
Monitoring Well 14
Monitoring Well 15
Monitoring Well 16
Monitoring Well 17
Monitoring Well 18
Monitoring Well 19
Monitoring Well 20

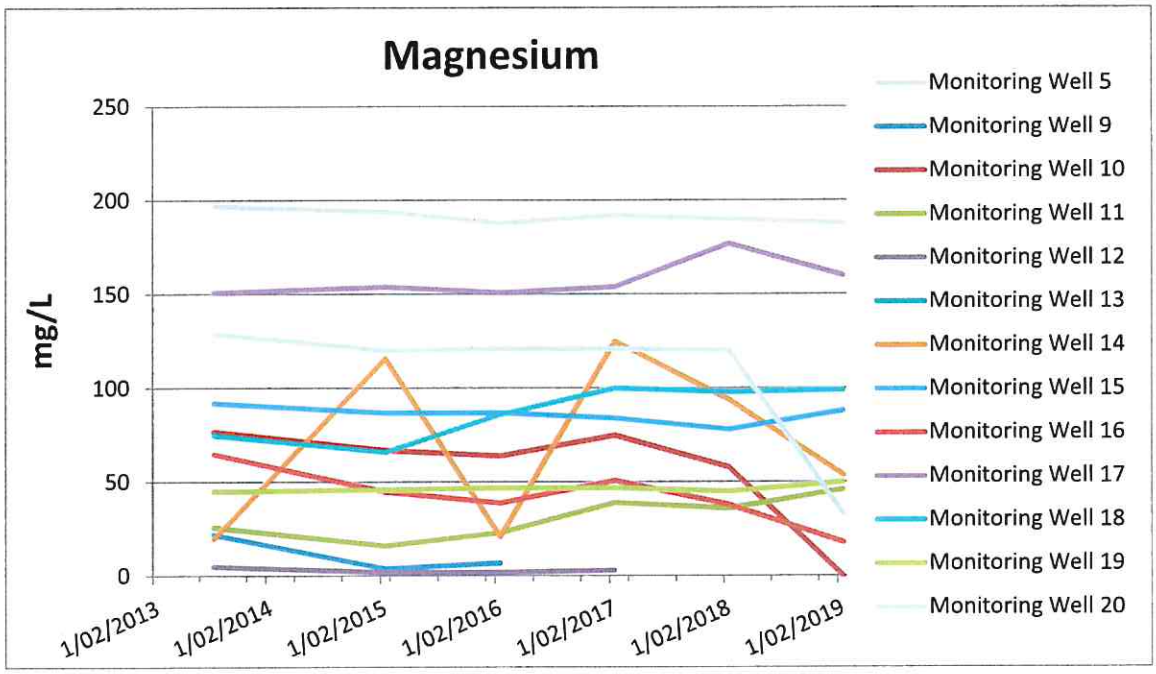

Calcium
mg/L
350
300
250
200
150
100
50
0
1/02/2013
1/02/2014
1/02/2015
1/02/2016
1/02/2017
1/02/2018
1/02/2019
Monitoring Well 5
Monitoring Well 9
Monitoring Well 10
Monitoring Well 11
Monitoring Well 12
Monitoring Well 13
Monitoring Well 14
Monitoring Well 15
Monitoring Well 16
Monitoring Well 17
Monitoring Well 18
Monitoring Well 19
Monitoring Well 20

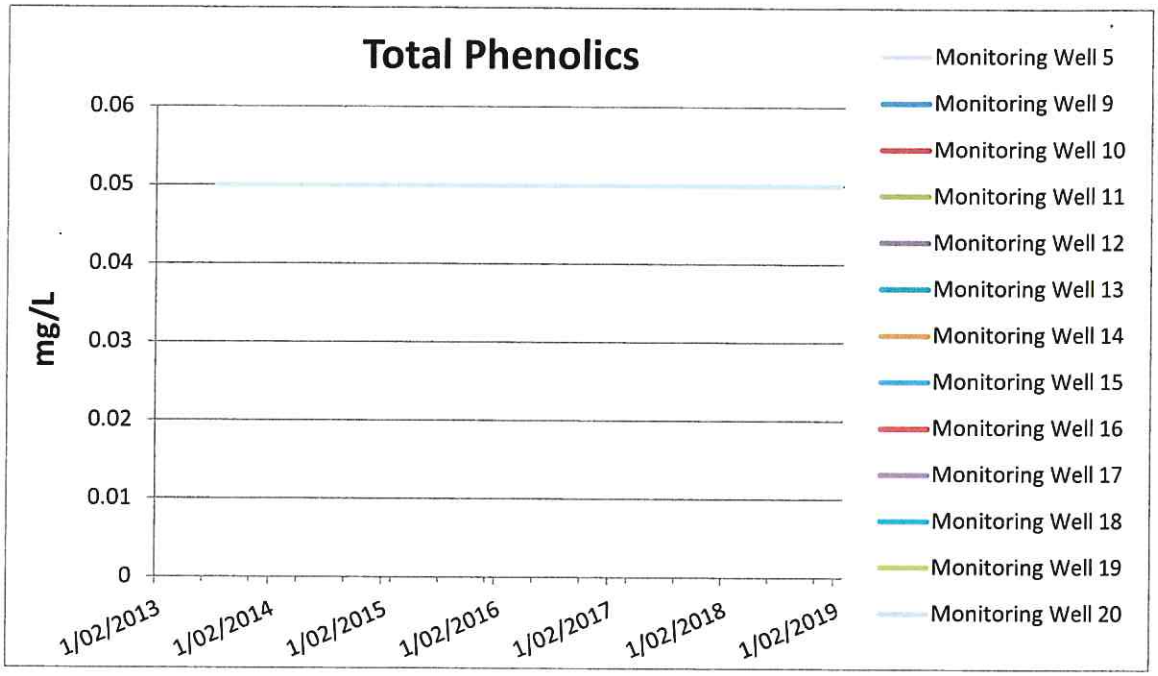

Fluoride
mg/L
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1/02/2013
1/02/2014
1/02/2015
1/02/2016
1/02/2017
1/02/2018
1/02/2019
Monitoring Well 5
Monitoring Well 9
Monitoring Well 10
Monitoring Well 11
Monitoring Well 12
Monitoring Well 13
Monitoring Well 14
Monitoring Well 15
Monitoring Well 16
Monitoring Well 17
Monitoring Well 18
Monitoring Well 19
Monitoring Well 20

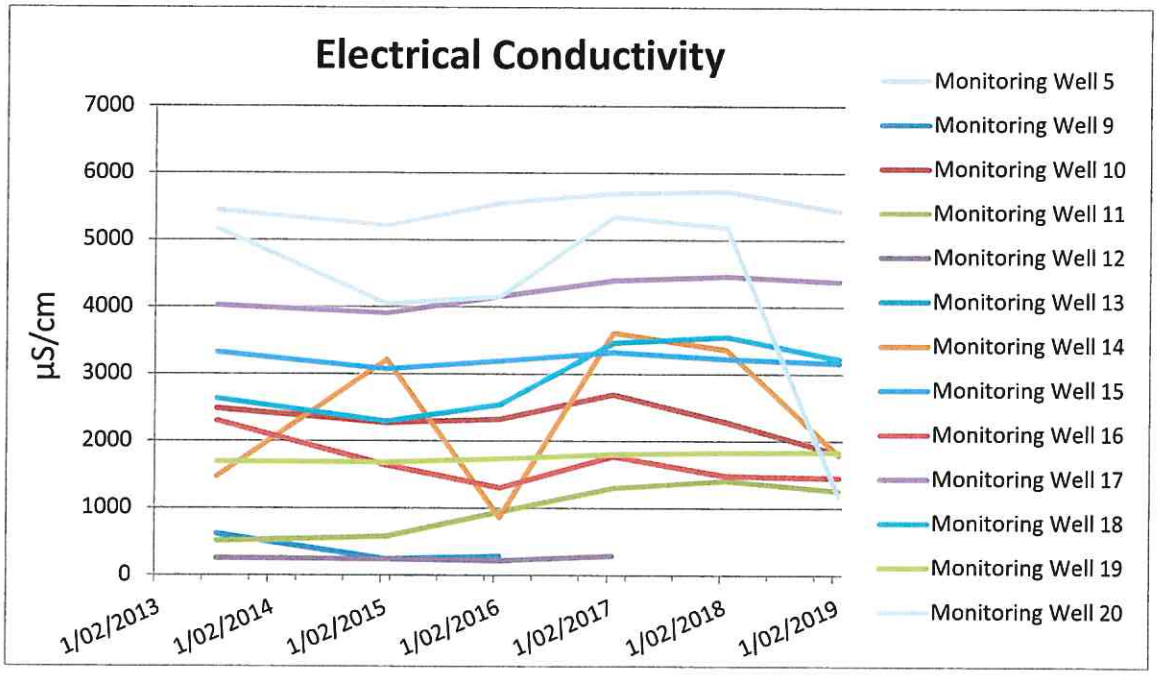

Potassium
mg/L
18
16
14
12
10
8
6
4
2
0
1/02/2013
1/02/2014
1/02/2015
1/02/2016
1/02/2017
1/02/2018
1/02/2019
Monitoring Well 5
Monitoring Well 9
Monitoring Well 10
Monitoring Well 11
Monitoring Well 12
Monitoring Well 13
Monitoring Well 14
Monitoring Well 15
Monitoring Well 16
Monitoring Well 17
Monitoring Well 18
Monitoring Well 19
Monitoring Well 20


Sulfate
mg/L
350
300
250
200
150
100
50
0
1/02/2013
1/02/2014
1/02/2015
1/02/2016
1/02/2017
1/02/2018
1/02/2019
Monitoring Well 5
Monitoring Well 9
Monitoring Well 10
Monitoring Well 11
Monitoring Well 12
Monitoring Well 13
Monitoring Well 14
Monitoring Well 15
Monitoring Well 16
Monitoring Well 17
Monitoring Well 18
Monitoring Well 19
Monitoring Well 20

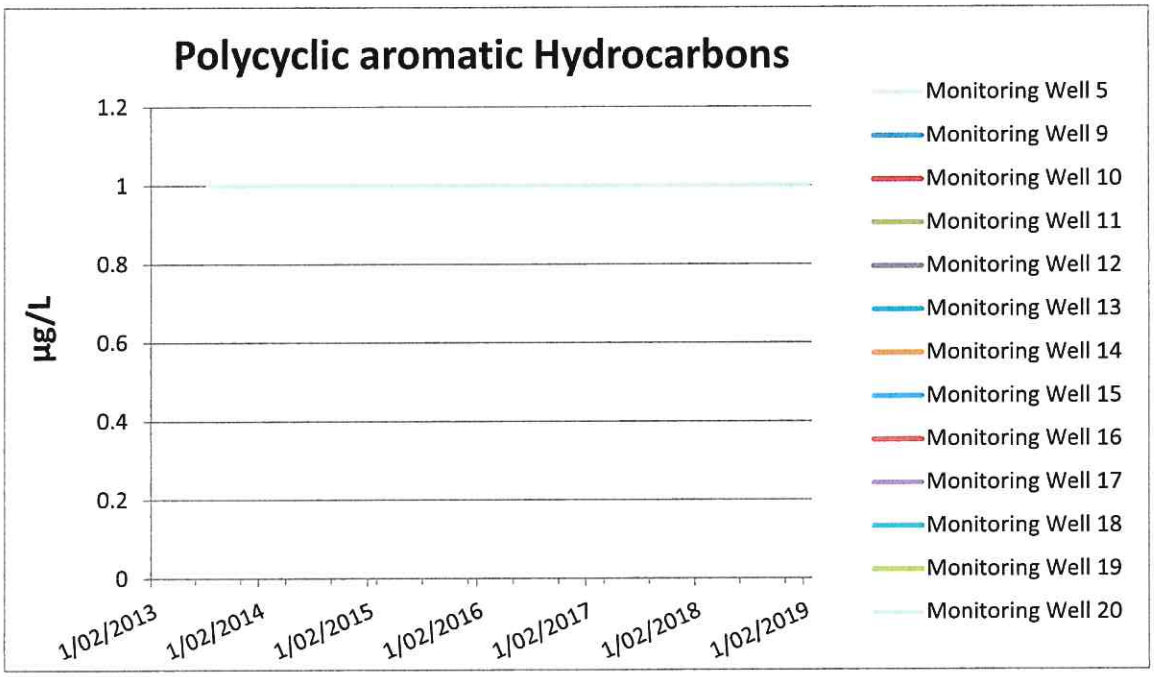

Sodium
mg/L
1000
900
800
700
600
500
400
300
200
100
0
1/02/2013
1/02/2014
1/02/2015
1/02/2016
1/02/2017
1/02/2018
1/02/2019
Monitoring Well 5
Monitoring Well 9
Monitoring Well 10
Monitoring Well 11
Monitoring Well 12
Monitoring Well 13
Monitoring Well 14
Monitoring Well 15
Monitoring Well 16
Monitoring Well 17
Monitoring Well 18
Monitoring Well 19
Monitoring Well 20

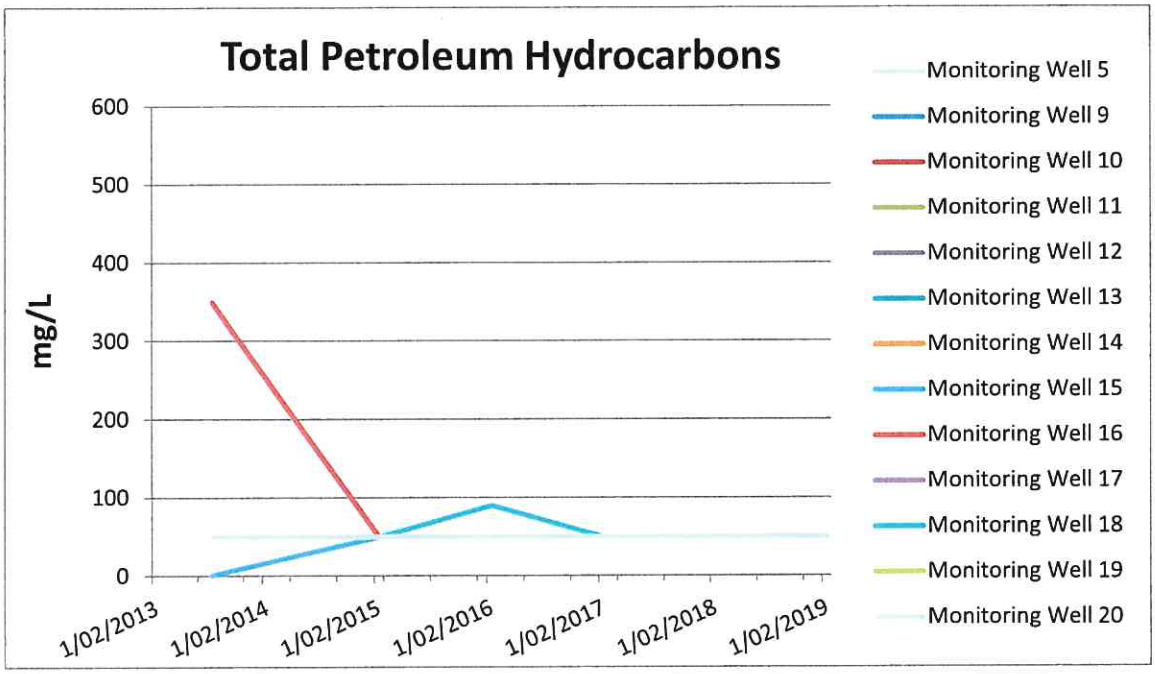

Magnesium
mg/L
250
200
150
100
50
0
1/02/2013
1/02/2014
1/02/2015
1/02/2016
1/02/2017
1/02/2018
1/02/2019
Monitoring Well 5
Monitoring Well 9
Monitoring Well 10
Monitoring Well 11
Monitoring Well 12
Monitoring Well 13
Monitoring Well 14
Monitoring Well 15
Monitoring Well 16
Monitoring Well 17
Monitoring Well 18
Monitoring Well 19
Monitoring Well 20

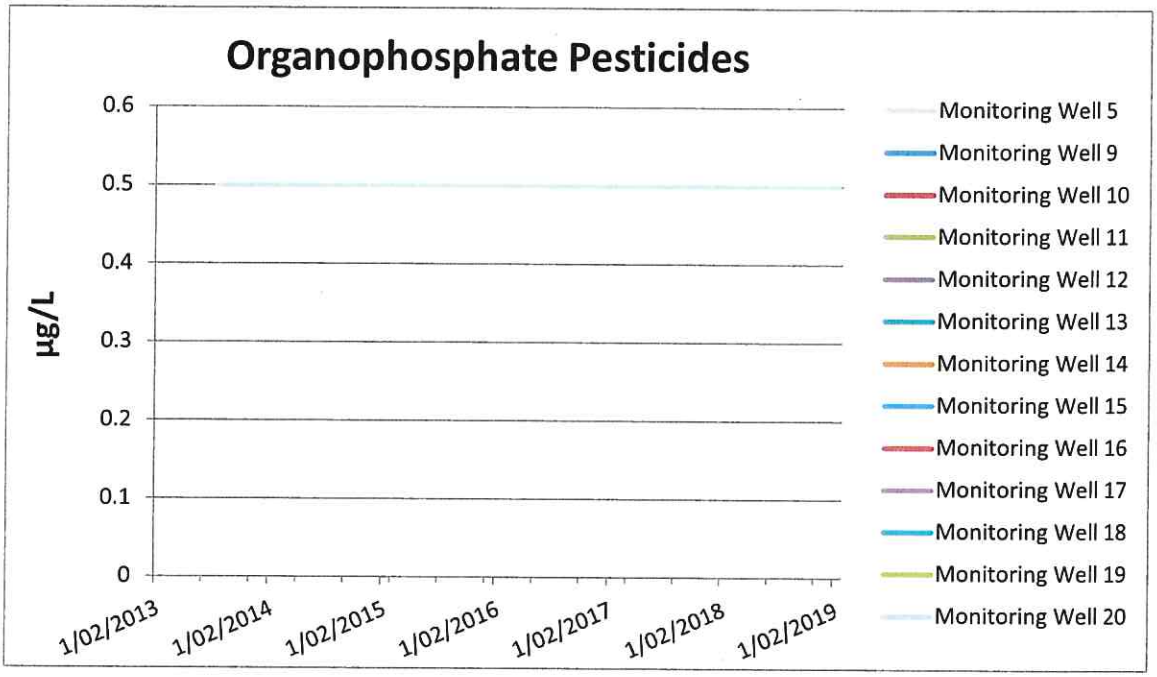

Total Phenolics
mg/L
0.06
0.05
0.04
0.03
0.02
0.01
0
1/02/2013
1/02/2014
1/02/2015
1/02/2016
1/02/2017
1/02/2018
1/02/2019
Monitoring Well 5
Monitoring Well 9
Monitoring Well 10
Monitoring Well 11
Monitoring Well 12
Monitoring Well 13
Monitoring Well 14
Monitoring Well 15
Monitoring Well 16
Monitoring Well 17
Monitoring Well 18
Monitoring Well 19
Monitoring Well 20

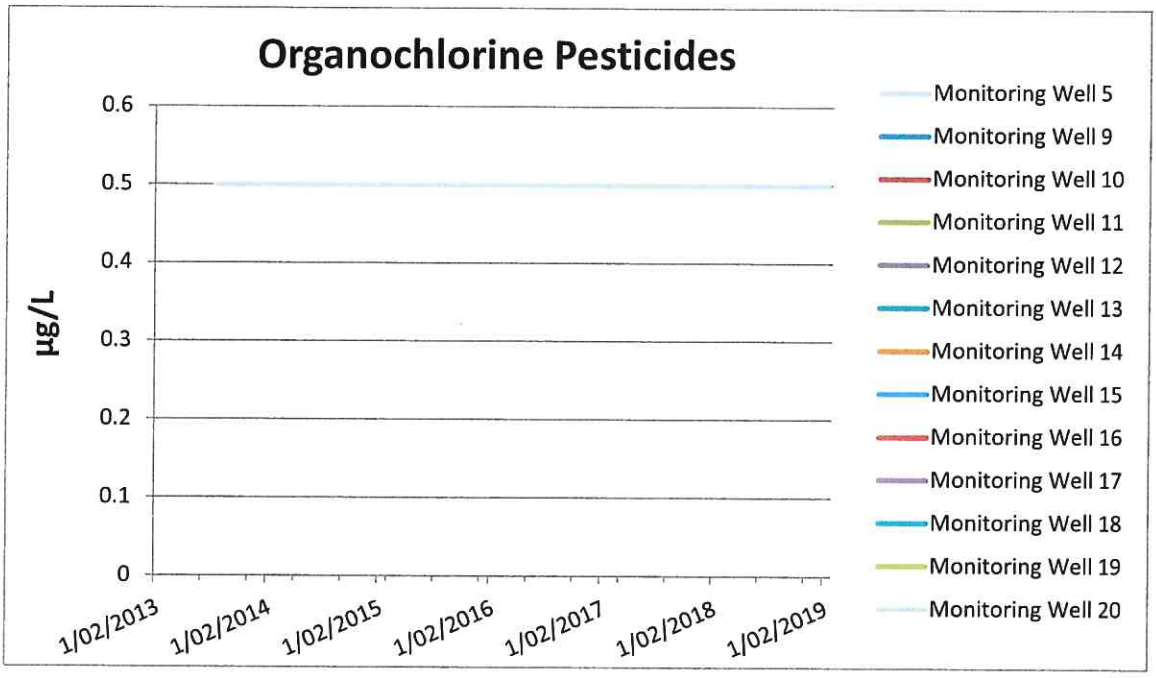

Electrical Conductivity
µS/cm
7000
6000
5000
4000
3000
2000
1000
0
1/02/2013
1/02/2014
1/02/2015
1/02/2016
1/02/2017
1/02/2018
1/02/2019
Monitoring Well 5
Monitoring Well 9
Monitoring Well 10
Monitoring Well 11
Monitoring Well 12
Monitoring Well 13
Monitoring Well 14
Monitoring Well 15
Monitoring Well 16
Monitoring Well 17
Monitoring Well 18
Monitoring Well 19
Monitoring Well 20

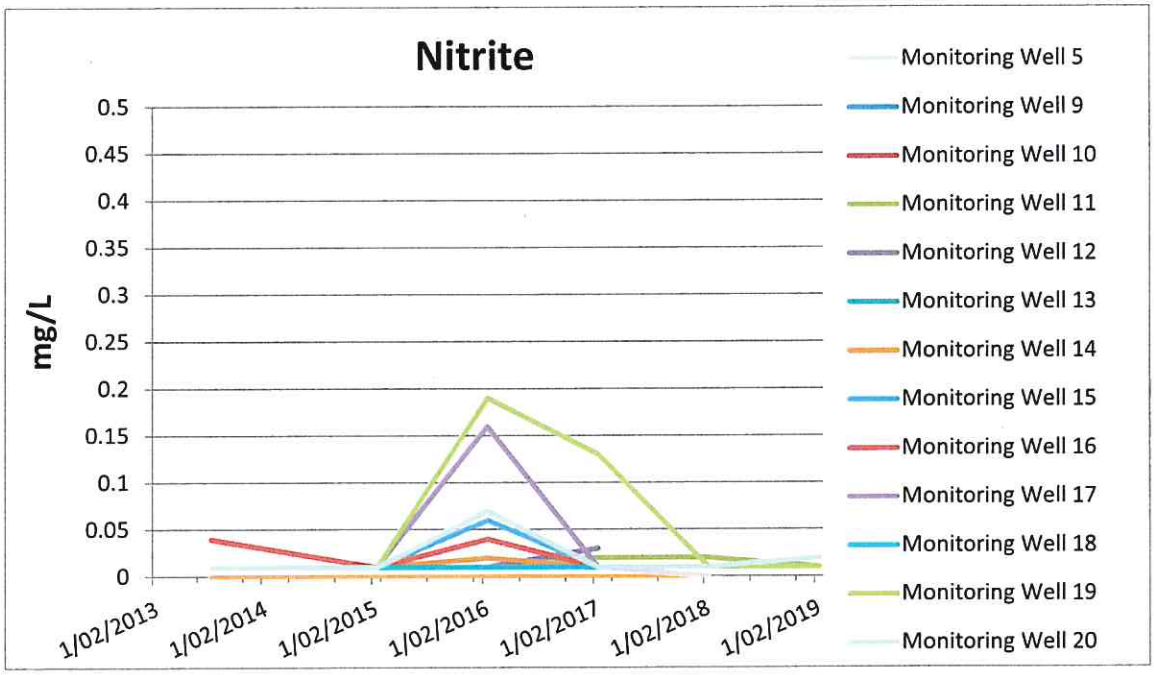
Whytes Gully Groundwater

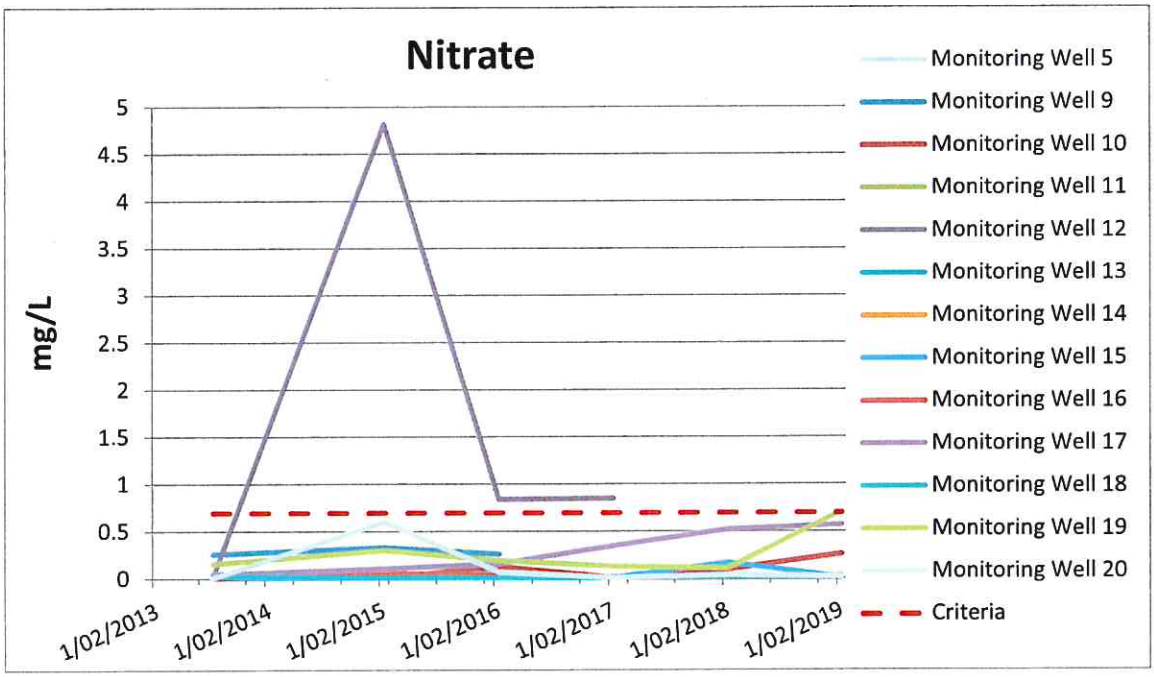


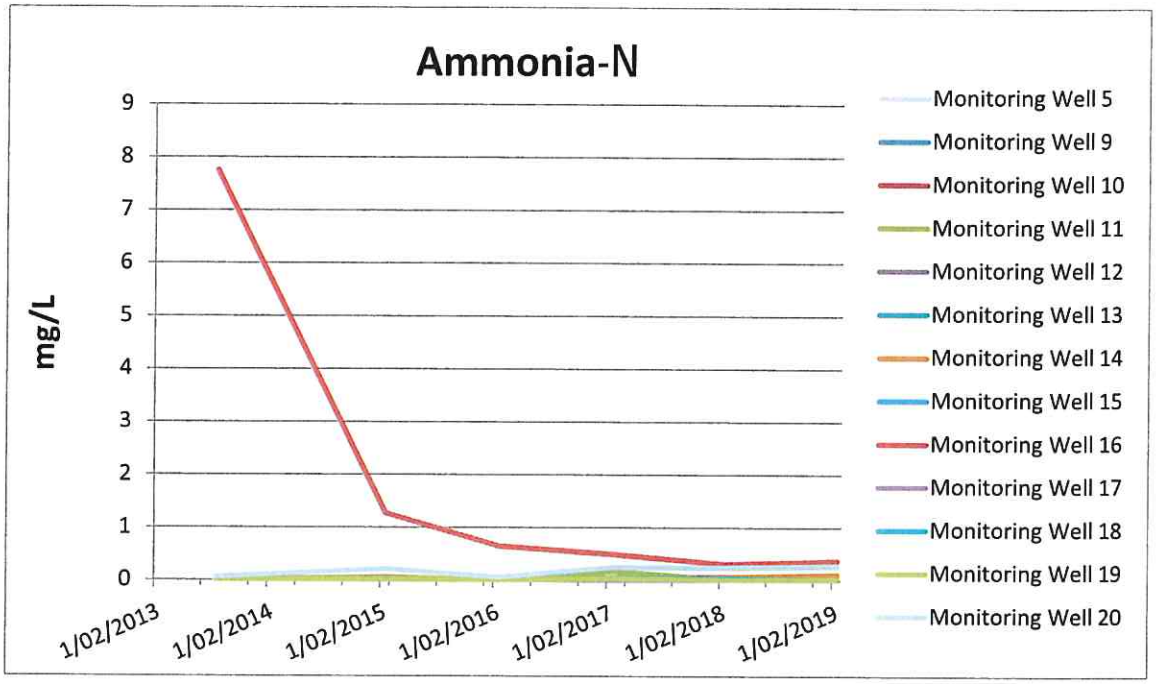


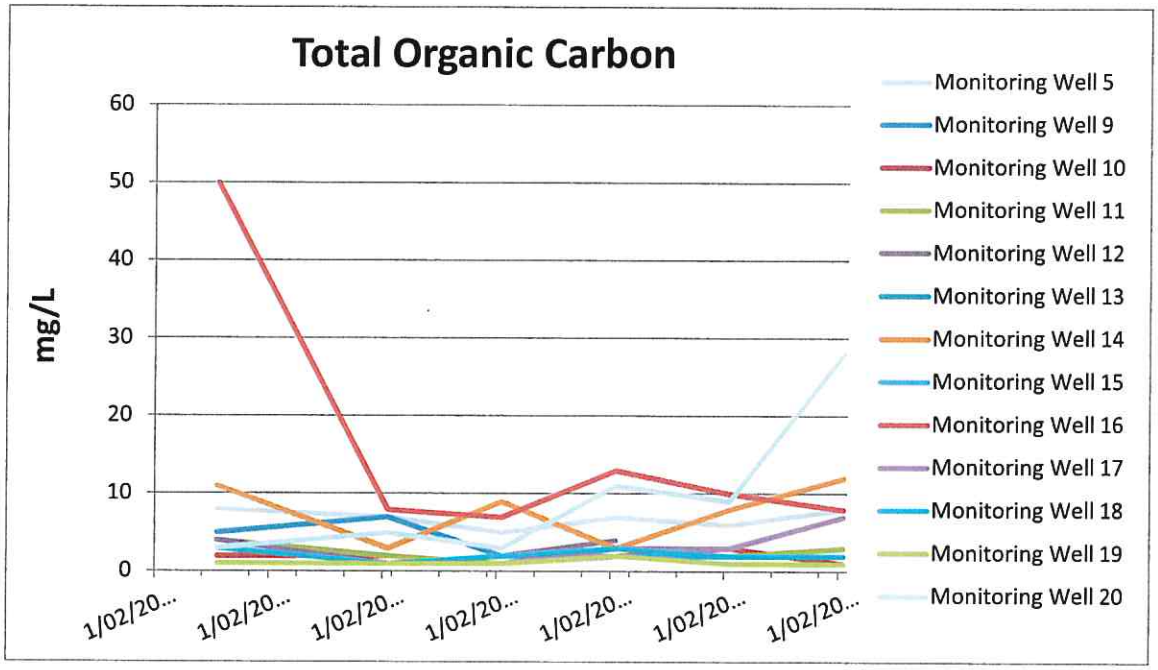

Organophosphate Pesticides
µg/L
0.6
0.5
0.4
0.3
0.2
0.1
0
1/02/2013
1/02/2014
1/02/2015
1/02/2016
1/02/2017
1/02/2018
1/02/2019
Monitoring Well 5
Monitoring Well 9
Monitoring Well 10
Monitoring Well 11
Monitoring Well 12
Monitoring Well 13
Monitoring Well 14
Monitoring Well 15
Monitoring Well 16
Monitoring Well 17
Monitoring Well 18
Monitoring Well 19
Monitoring Well 20


Organochlorine Pesticides
µg/L
0.6
0.5
0.4
0.3
0.2
0.1
0
1/02/2013
1/02/2014
1/02/2015
1/02/2016
1/02/2017
1/02/2018
1/02/2019
Monitoring Well 5
Monitoring Well 9
Monitoring Well 10
Monitoring Well 11
Monitoring Well 12
Monitoring Well 13
Monitoring Well 14
Monitoring Well 15
Monitoring Well 16
Monitoring Well 17
Monitoring Well 18
Monitoring Well 19
Monitoring Well 20

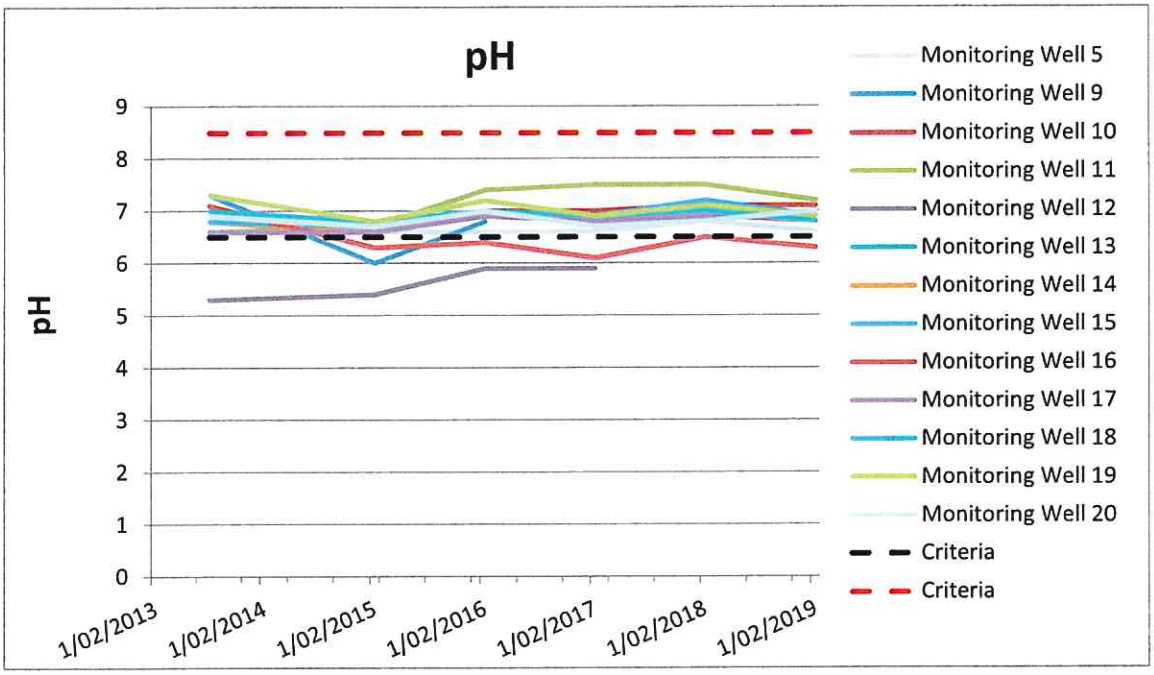

Nitrite
mg/L
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
1/02/2013
1/02/2014
1/02/2015
1/02/2016
1/02/2017
1/02/2018
1/02/2019
Monitoring Well 5
Monitoring Well 9
Monitoring Well 10
Monitoring Well 11
Monitoring Well 12
Monitoring Well 13
Monitoring Well 14
Monitoring Well 15
Monitoring Well 16
Monitoring Well 17
Monitoring Well 18
Monitoring Well 19
Monitoring Well 20


Nitrate
mg/L
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
1/02/2013
1/02/2014
1/02/2015
1/02/2016
1/02/2017
1/02/2018
1/02/2019
Monitoring Well 5
Monitoring Well 9
Monitoring Well 10
Monitoring Well 11
Monitoring Well 12
Monitoring Well 13
Monitoring Well 14
Monitoring Well 15
Monitoring Well 16
Monitoring Well 17
Monitoring Well 18
Monitoring Well 19
Monitoring Well 20
Criteria


Ammonia-N
mg/L
9
8
7
6
5
4
3
2
1
0
1/02/2013
1/02/2014
1/02/2015
1/02/2016
1/02/2017
1/02/2018
1/02/2019
Monitoring Well 5
Monitoring Well 9
Monitoring Well 10
Monitoring Well 11
Monitoring Well 12
Monitoring Well 13
Monitoring Well 14
Monitoring Well 15
Monitoring Well 16
Monitoring Well 17
Monitoring Well 18
Monitoring Well 19
Monitoring Well 20


Total Organic Carbon
mg/L
60
50
40
30
20
10
0
1/02/20...
1/02/20...
1/02/20...
1/02/20...
1/02/20...
1/02/20...
1/02/20...
Monitoring Well 5
Monitoring Well 9
Monitoring Well 10
Monitoring Well 11
Monitoring Well 12
Monitoring Well 13
Monitoring Well 14
Monitoring Well 15
Monitoring Well 16
Monitoring Well 17
Monitoring Well 18
Monitoring Well 19
Monitoring Well 20

Whytes Gully Groundwater



Appendix C: Trade Wastewater: Tabulated Results and Trends

Table 1: **Trade Waste Results**
Client: Wollongong City Council

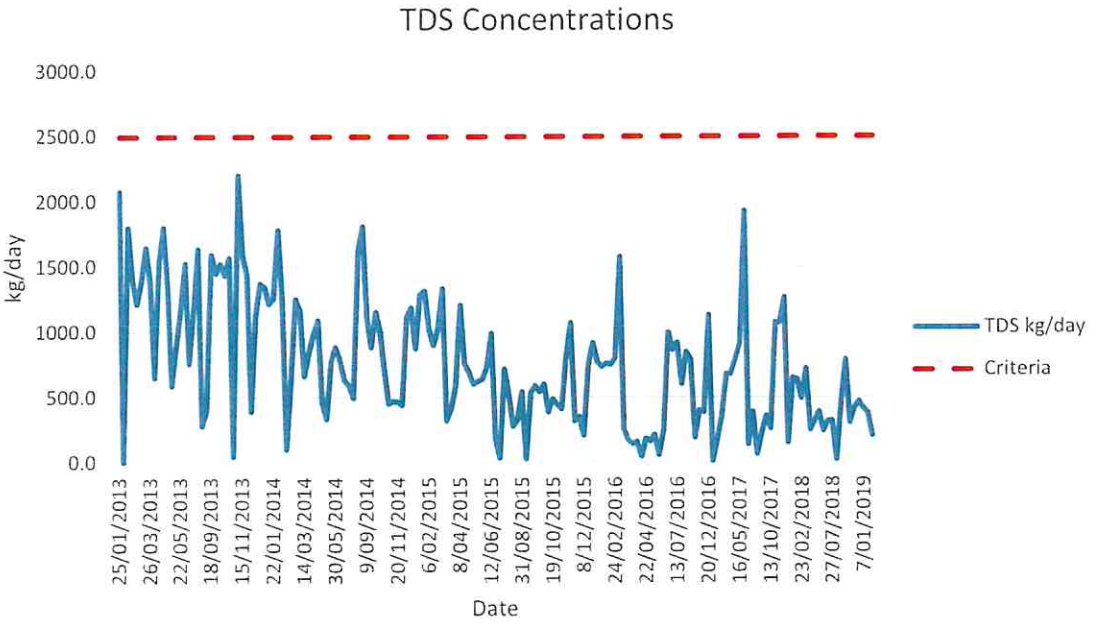
		Discharge Measurements			Physico-chemical parametres					
Sample ID	Sample Date	Meter Reading (start)	Meter Reading (finish)	Volume Discharged	Discrete Start pH (start)	Ammonia as N	Suspended Solids	Total Dissolved Solids	Biochemical oxygen Demand	Electrical Conductivity
		L	L	L	pH unit	mg/L	mg/L	mg/L	mg/L	µS/cm
Acceptance Standard				605kL / day	7.0-10.0	100	600	10,000		
MDM										
LTADM										
Trade Waste Discharge Point	16/03/2018	272079	272210	131	7.9	0.1	79	5490	6	8440
	10/04/2018	275982	276030	48	8.4	0.1	22	5180	12	7970
	3/05/2018	277867	277919	52	8.2	0.1	28	6120	15	9420
	29/05/2018	280810	280873	63	8.5	0.6	34	6160	27	9480
	13/06/2018	282265	282318	53	8.8	0.6	78	4580	46	7050
	5/07/2018	284430	284480	50	8.4	0.1	77	6310	38	9710
	27/07/2018	285664	285711	47	8.6	0.1	239	6820	25	10500
	28/08/2018	286864	286870	6	8.6	24.6	82	3560	54	5470
	12/09/2018	287937	287998	61	8.4	0.6	119	7670	22	11800
	4/10/2018	289092	289186	94	8.4	0.1	176	8380	31	12900
	22/10/2018	291803	291848	45	8.5	0.1	82	6760	2	10400
	14/11/2018	292885	292944	59	9.2	0.6	39	7080	2	10900
	14/12/2018	295440	295525	85	8.3	0.3	39	5490	8	8440
	7/01/2019	296673	296733	60	8.3	0.1	34	6890	5	10600
	29/01/2019	298532	298591	59	8	0.9	19	6440	14	9910
	19/02/2019	299881	299913	32	8.6	0.1	16	6440	2	9910
	2018/2019 LTADM			-	-	-	-	-	-	-

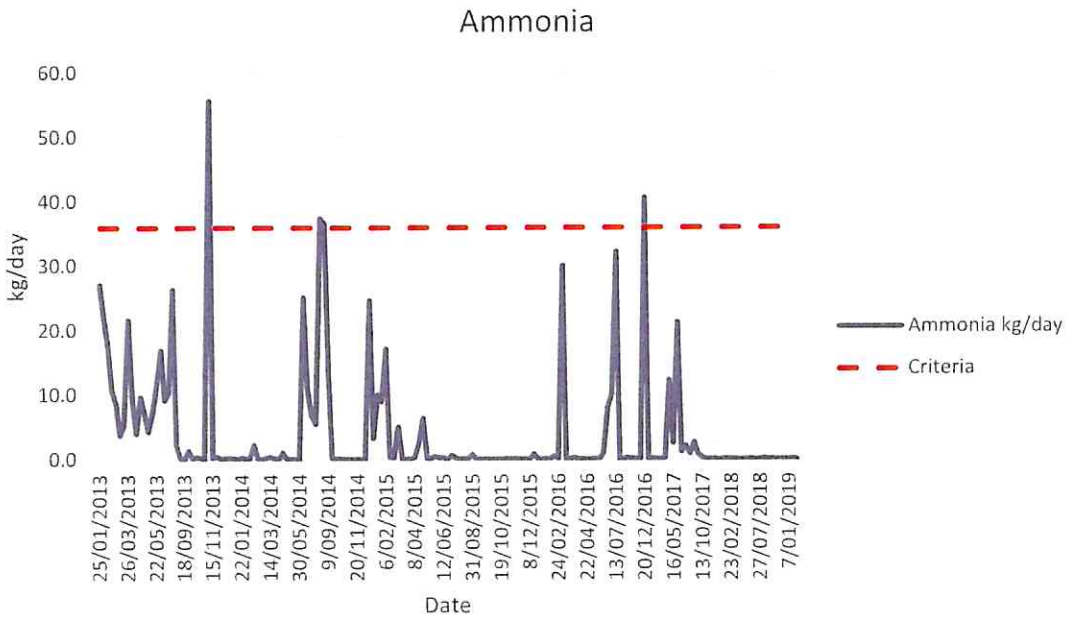
MDM Maximum Daily Mass Equal to the average daily concentration (mg/L) multiplied by the total discharge (kL) and converted to kilograms
LTADM Long Term Average Daily Mass Arithmetic average of all daily mass discharges

Table 1: **Trade Waste Results**
Client: Wollongong City Council

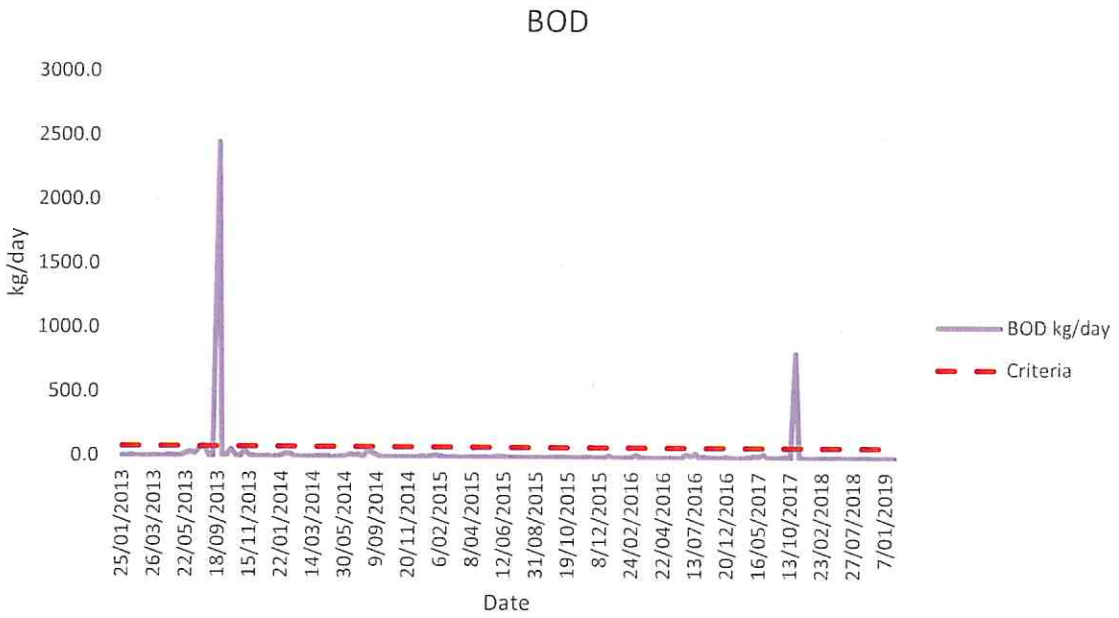
Sample ID	Sample Date			Maximum Daily Mass (Calculated)			
		pH Finish	Temperature	Ammonia	Suspended Solids	Total Dissolved Solids	Biochemical Oxygen Demand
		pH unit	°C	kg/day	kg/day	kg/day	kg/day
Acceptance Standard		7.0-10.0	< 38				
MDM				36	150	2,500	80
LTADM				3.98	19.5	683.1	7.2
Trade Waste Discharge Point	16/03/2018	8	26	0.0	10.3	719.2	0.8
	10/04/2018	8.4	23	0.0	1.1	248.6	0.6
	3/05/2018	8.2	16	0.0	1.5	318.2	0.8
	29/05/2018	8.6	17	0.04	2.14	388.08	1.70
	13/06/2018	8.3	16	0.03	4.91	288.54	2.90
	5/07/2018	8.46	12	0.01	4.85	397.53	2.39
	27/07/2018	8.8	10	0.00	15.06	429.66	1.58
	28/08/2018	8.6	13	0.15	5.17	224.28	3.40
	12/09/2018	8.4	18	0.04	7.50	483.21	1.39
	4/10/2018	8.5	18	0.01	11.09	527.94	1.95
	22/10/2018	8.6	21	0.00	5.17	425.88	0.13
	14/11/2018	9	22	0.04	2.46	446.04	0.13
	14/12/2018	8.3	27	0.03	2.46	345.87	0.50
	7/01/2019	8.1	26	0.01	2.14	434.07	0.32
	29/01/2019	8	29	0.05	1.20	405.72	0.88
	19/02/2019	8.3	26	0.00	1.01	405.72	0.13
	2018/2019 LTADM	-		0.03	4.88	405.53	1.22

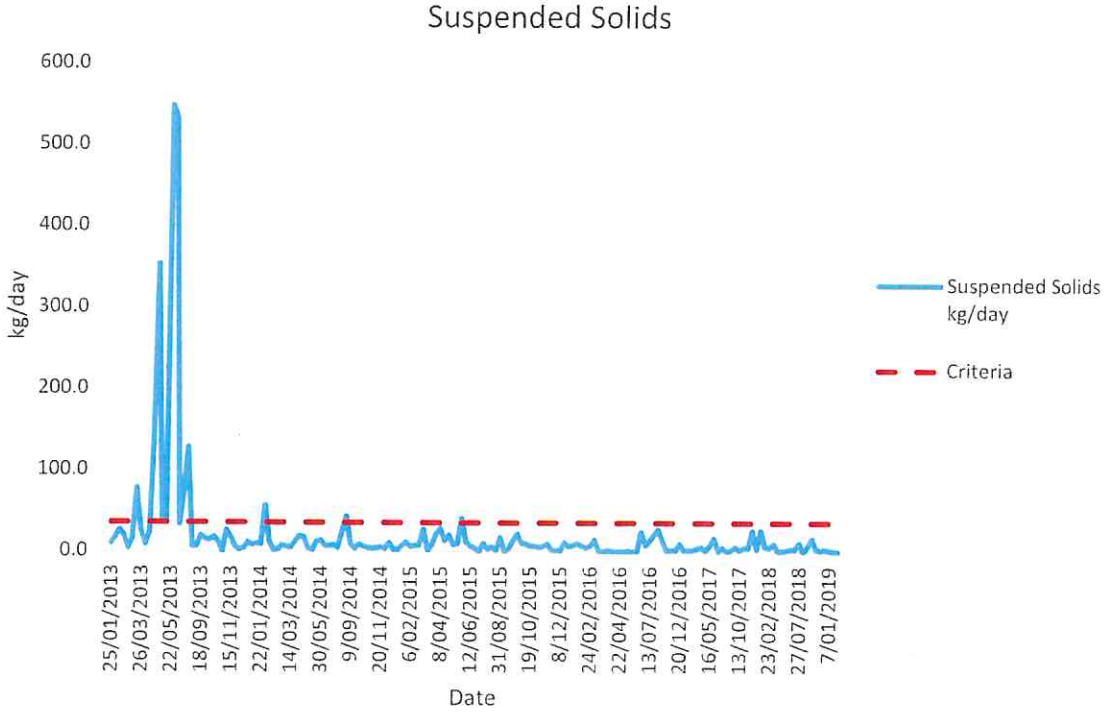
Trade Wastewater





Trade Wastewater





Appendix D: Tabulated Results: Leachate

Table 1: Leachate Results
Client: Wollongong City Council

Sample Date	Sampling Location	Total Dissolved Solids	Suspended Solids (SS)	Ammonia as N	pH	Temperature
ANZECC 2000 Fresh Water (95%)		-	-	0.9	-	-
5/03/2018	Pond S1	5580	200	132	4.9	23.4
5/03/2018	Pond P1	5040	331	120	5.7	23.2
5/03/2018	Balance Tank	6840	97	0.1	8.6	23.4
5/03/2018	Eastern Arm Collection Well	7470	22	1530	8.1	37.5
12/03/2018	Pond S1	5500	199	111	4.7	24.5
12/03/2018	Pond P1	5460	274	114	5.3	24.1
12/03/2018	Balance Tank	6910	66	0.1	7.1	23.7
12/03/2018	Eastern Arm Collection Well	9340	881	1620	8	36.6
19/03/2018	Pond S1	5530	111	117	5.2	25.4
19/03/2018	Pond P1	5720	209	129	5.2	25.3
19/03/2018	Balance Tank	6480	120	6.3	7.5	25.4
19/03/2018	Eastern Arm Collection Well	7010	369	1630	8.1	38.1
26/03/2018	Pond S1	4840	105	98.9	6.4	21.3
26/03/2018	Pond P1	4580	92	129	7.8	21.2
26/03/2018	Balance Tank	5870	92	0.1	8	22.4
26/03/2018	Eastern Arm Collection Well	7820	262	1560	8.1	33.1
3/04/2018	Pond S1	4600	66	95.9	4	23.6
3/04/2018	Pond P1	4810	107	98.9	5.9	23
3/04/2018	Balance Tank	5650	39	0.1	8.4	23.6
3/04/2018	Eastern Arm Collection Well	7900	170	1590	8	35.7
9/04/2018	Pond S1	4990	58	94.2	4.7	23.7
9/04/2018	Pond P1	5300	118	111	6.1	23.7
9/04/2018	Balance Tank	5860	40	0.1	8.4	23.3
9/04/2018	Eastern Arm Collection Well	7870	161	1610	8.1	39.8
16/04/2018	Pond S1	5070	34	77.1	5.2	25.2
16/04/2018	Pond P1	5690	117	108	5.1	22.6
16/04/2018	Balance Tank	5920	34	0.1	8.3	23.4
16/04/2018	Eastern Arm Collection Well	8300	153	1540	8	37
23/04/2018	Pond S1	4760	26	68.5	5.4	21.2
23/04/2018	Pond P1	5330	245	114	5	20.9
23/04/2018	Balance Tank	6830	65	0.1	8.4	21.7
23/04/2018	Eastern Arm Collection Well	9740	203	1560	8	36.4
7/05/2018	Pond S1	4970	29	71.4	6	15.7
7/05/2018	Pond P1	5430	101	131	7.1	17.2
7/05/2018	Balance Tank	522	74	37.1	7.4	20
7/05/2018	Eastern Arm Collection Well	8130	307	1580	8	33.9
14/05/2018	Pond S1	4750	74	42.8	6.6	14
14/05/2018	Pond P1	5620	309	123	6.3	15.1
14/05/2018	Balance Tank	7000	52	12.6		17
14/05/2018	Eastern Arm Collection Well	9150	351	1460		33.9
22/05/2018	Pond S1	3640	32	39.3	7.1	17.7
22/05/2018	Pond P1	3930	72	48.3	6.2	18.1
22/05/2018	Balance Tank	3880	84	23.8	9.4	19.6
22/05/2018	Eastern Arm Collection	6080	11	985	8	35.9
19/06/2018	Pond S1	Empty	Empty	Empty	Empty	Empty
19/06/2018	Pond P1	5800	508	157	6.6	11.9
19/06/2018	Balance Tank	7630	163	0.3	8.6	14.5
19/06/2018	Eastern Arm Collection Well	9250	731	1730	8.4	34.6
25/06/2018	Pond S1	1400	8	2	7	10.2
25/06/2018	Pond P1	4710	424	151	6.4	12.4
25/06/2018	Balance Tank	4690	385	7.7	8.1	14.1
25/06/2018	Eastern Arm Collection Well	8010	190	1700	8.1	32.3
2/07/2018	Pond S1	Empty	Empty	Empty	Empty	Empty
2/07/2018	Pond P1	7.7	273	174	7.7	14
2/07/2018	Balance Tank	8.9	110	0.1	8.9	16.5
2/07/2018	Eastern Arm Collection Well	8.1	310	1760	8.1	33.1
9/07/2018	Pond S1	Empty	Empty	Empty	Empty	Empty
9/07/2018	Pond P1	3960	314	143	6.4	13.4
9/07/2018	Balance Tank	6660	100	0.1	8.8	15.2
9/07/2018	Eastern Arm Collection Well	5720	264	1740	8.2	30.8
16/07/2018	Pond S1	Empty	Empty	Empty	Empty	Empty
16/07/2018	Pond P1	5280	260	145	6.7	13
16/07/2018	Balance Tank	6510	143	0.1	9	13
16/07/2018	Eastern Arm Collection Well	7240	226	1820	8.4	34.2

Table 3: **Leachate Results**
Client: Wollongong City Council

Sample Date	Sampling Location	Total Dissolved Solids	Suspended Solids (SS)	Ammonia as N	pH	Temperature
ANZECC 2000 Fresh Water (95%)		-	-	0.9	-	-
23/07/2018	Pond S1	Empty	Empty	Empty	Empty	Empty
23/07/2018	Pond P1	5850	288	175	6.5	9.2
23/07/2018	Balance Tank	8040	180	0.3	9	11.2
23/07/2018	Eastern Arm Collection Well	9880	166	1740	8.1	30.4
30/07/2018	Pond S1	Empty	Empty	Empty	Empty	Empty
30/07/2018	Pond P1	5650	260	175	6	12
22/05/2018	Balance Tank	466	93	46.6	7.3	14.2
30/07/2018	Eastern Arm Collection Well	9430	925	1630	8.1	26.2
6/08/2018	Pond S1	Empty	Empty	Empty	Empty	Empty
6/08/2018	Pond P1	5500	243	190	6.4	12.4
6/08/2018	Balance Tank	7370	139	1.5	8.8	13.8
6/08/2018	Eastern Arm Collection Well	9080	334	1780	8.3	28
20/08/2018	Pond S1	Dry	Dry	Dry	Dry	Dry
20/08/2018	Pond P1	5560	230	208	6.4	13.8
20/08/2018	Balance Tank	5950	165	0.1	8.6	12.2
20/08/2018	Eastern Arm Collection Well	7390	20	1750	8.1	32.2
27/08/2018	Pond S1	Dry	Dry	Dry	Dry	Dry
27/08/2018	Pond P1	6130	182	235	6.6	13.6
27/08/2018	Balance Tank	6830	101	2.8	8.6	14.2
27/08/2018	Eastern Arm Collection Well	6050	131	1920	8.2	32.2
3/09/2018	Pond S1	Dry	Dry	Dry	Dry	Dry
3/09/2018	Pond P1	5280	151	235	6.3	13.8
3/09/2018	Balance Tank	7940	111	0.6	8.3	14.5
3/09/2018	Eastern Arm Collection Well	8980	26	1850	8.2	29.8
10/09/2018	Pond S1	Dry	Dry	Dry	Dry	Dry
10/09/2018	Pond P1	6130	109	202	6	18.3
10/09/2018	Balance Tank	6660	125	0.6	8.6	19.1
10/09/2018	Eastern Arm Collection Well	9260	75	1860	8.1	34
17/09/2018	Pond S1	-	-	-	-	-
17/09/2018	Pond P1	-	-	-	-	-
17/09/2018	Balance Tank	-	-	-	-	-
17/09/2018	Eastern Arm Collection Well	-	-	-	-	-
24/09/2018	Pond S1	Dry	Dry	Dry	Dry	Dry
24/09/2018	Pond P1	6620	218	204	6	17
24/09/2018	Balance Tank	7920	99	0.1	8.5	17
24/09/2018	Eastern Arm Collection Well	9020	187	1930	8.1	34.7
4/10/2018	Pond S1	Dry	Dry	Dry	Dry	Dry
4/10/2018	Pond P1	7160	220	207	5.8	19.3
4/10/2018	Balance Tank	7720	62	0.1	8.4	18
4/10/2018	Eastern Arm Collection Well	7550	432	1780	8.1	35.2
8/10/2018	Pond S1	Dry	Dry	Dry	Dry	Dry
8/10/2018	Pond P1	5160	232	174	6.7	18.5
8/10/2018	Balance Tank	6030	111	10.4	8.4	19.2
8/10/2018	Eastern Arm Collection Well	7300	13	1830	8.1	32.8
15/10/2018	Pond S1	Dry	Dry	Dry	Dry	Dry
15/10/2018	Pond P1	5120	190	134	5.6	17.1
15/10/2018	Balance Tank	7310	88	3.6	8.1	18.9
15/10/2018	Eastern Arm Collection Well	9620	11	1790	8	37
22/10/2018	Pond S1	Dry	Dry	Dry	Dry	Dry
22/10/2018	Pond P1	3390	175	119	5.5	21.1
22/10/2018	Balance Tank	3830	183	0.9	8.4	20.6
22/10/2018	Eastern Arm Collection Well	8270	10	1620	8.1	30.4
29/10/2018	Pond S1	Dry	Dry	Dry	Dry	Dry
29/10/2018	Pond P1	4100	162	119	5	21.7
29/10/2018	Balance Tank	5250	47	0.6	8.8	20.8
29/10/2018	Eastern Arm Collection Well	8010	12	1630	8.1	32.8
5/11/2018	Pond S1	3530	74	113	6	26.6
5/11/2018	Pond P1	4680	111	134	5.1	25.9
5/11/2018	Balance Tank	6660	80	0.6	8.7	25.6
5/11/2018	Eastern Arm Collection Well	5230	5	1680	8	35.3
12/11/2018	Pond S1	4520	30	104	104	24.8
12/11/2018	Pond P1	3830	184	128	128	24.1
12/11/2018	Balance Tank	5400	49	1.5	1.5	25

Table 3: **Leachate Results**
Client: Wollongong City Council

Sample Date	Sampling Location	Total Dissolved Solids	Suspended Solids (SS)	Ammonia as N	pH	Temperature
ANZECC 2000 Fresh Water (95%)		-	-	0.9	-	-
12/11/2018	Eastern Arm Collection Well	7450	6		1680	37.3
29/10/2018	Eastern Arm Collection Well	8010	12	1630	8.1	32.8
19/11/2018	Pond S1	4570	14	113	6.3	20.3
19/11/2018	Pond P1	6210	234	136	5.2	20.5
19/11/2018	Balance Tank	7060	64	0.6	8.7	20.8
19/11/2018	Eastern Arm Collection Well	8940	10	1590	8	37.8
26/11/2018	Pond S1	3440	108	101	7.2	20.4
26/11/2018	Pond P1	6730	394	142	5.1	20.1
26/11/2018	Balance Tank	7020	107	0.1	8.7	21
26/11/2018	Eastern Arm Collection Well	10200	5	1710	8.2	32
3/12/2018	Pond S1	4060	25	83.1	7.4	23.3
3/12/2018	Pond P1	5350	212	113	5.5	22.8
3/12/2018	Balance Tank	6110	215	0.1	7.8	23.7
3/12/2018	Eastern Arm Collection Well	7930	138	1720	8	32.4
10/12/2018	Pond S1	3790	61	88.4	5.3	24.9
10/12/2018	Pond P1	4000	168	120	5.1	26
10/12/2018	Balance Tank	4060	80	1.8	8.2	26.7
10/12/2018	Eastern Arm Collection Well	7670	14	1540	8	36.1
17/12/2018	Pond S1	4410	35	85.8	5.2	25.2
17/12/2018	Pond P1	5640	93	127	5.2	26.2
17/12/2018	Balance Tank	6330	48	2	7.9	25.4
17/12/2018	Eastern Arm Collection Well	8630	9	1610	8	34.8
7/01/2019	Pond S1	4490	8	59.4	6.8	24.5
7/01/2019	Pond P1	6310	63	145	5.8	24.7
7/01/2019	Balance Tank	7400	164	0.1	8.4	26.3
7/01/2019	Eastern Arm Collection Well	7550	26	1760	8.1	37.8
14/01/2019	Pond S1	3470	10	74.2	7	
14/01/2019	Pond P1	5960	58	130	5.6	
14/01/2019	Balance Tank	7180	56	0.3	8.2	
14/01/2019	Eastern Arm Collection Well	8700	85	1720	8.2	
4/02/2019	Pond S1	3940	32	62.3	5.6	28.7
4/02/2019	Pond P1	5200	50	130	5.9	27.7
4/02/2019	Balance Tank	7030	30	0.1	8.2	30.2
4/02/2019	Eastern Arm Collection Well	9110	<5	1750	8	35.9
11/02/2019	Pond S1	3780	37	61.2	5.7	29.4
11/02/2019	Pond P1	5760	67	134	5.7	27.3
11/02/2019	Balance Tank	6710	51	0.1	8.7	30.3
11/02/2019	Eastern Arm Collection Well	8570	45	1790	7.9	30.3
18/02/2019	Pond S1	4280	15	58.2	6.1	25.8
18/02/2019	Pond P1	6780	83	122	5.5	25.9
18/02/2019	Balance Tank	6940	26	0.1	8.4	25.2
18/02/2019	Eastern Arm Collection Well	8800	37	1620	8.2	38.5
25/02/2019	Pond S1	4270	14	67	6.5	22.5
25/02/2019	Pond P1	7180	47	143	5.9	22.5
25/02/2019	Balance Tank	7430	46	0.1	8.3	22.8
25/02/2019	Eastern Arm Collection Well	8750	22	1760	8.2	37.8
1/03/2019	Pond S1	3840	13	55.3	5.9	25
1/03/2019	Pond P1	6630	47	148	5.6	24.7
1/03/2019	Balance Tank	9010	19	0.1	8.2	38.2
1/03/2019	Eastern Arm Collection Well	7500	<5	1730	8	24.8

Appendix E: Landfill Gas: Tabulated Results and Trends

Table 1: **Subsurface Gas Results**
Client: Wollongong City Council

Monloing Point ID	Sample ID	Sample Date	CH4 % v/v	CH4 Peak % v/v	CO2 % v/v	CO2 peak % v/v	Bal %	Int Flow l/h	Baro mb	Relative Pressure mb
NSW EPA (2016) Solid Waste Landfills			1 % v/v	1 % v/v	1.5 % v/v	1.5 % v/v				
		9/03/2018	0.0006	-	-	-	-	-	-	-
		11/04/2018	0.0003	-	-	-	-	-	-	-
		2/05/2018	0.0002	-	-	-	-	-	-	-
		12/06/2018	0.0003	-	-	-	-	-	-	-
		18/07/2018	0.0003	-	-	-	-	-	-	-
21	LFGMW1	1/08/2018	< 0.1	0.1	6.3	6.5	77.4	0.2	1016	0.03
		14/08/2018	< 0.1	< 0.1	6.3	6.3	77	0.3	1018	0.02
		12/09/2018	< 0.1	< 0.1	8.8	8.8	77.3	0.04	1018	0.03
		16/10/2018	< 0.1	< 0.1	8.8	8.8	79.2	0.5	1020	0.07
		26/11/2018	0	0	4.1	4.1	80	0.6	1004	0.02
		5/12/2018	< 0.1	< 0.1	-	10.5	80.6	0	1007	0.03
		16/01/2019	0	0	8.6	8.6	79.6	0.2	1007	0.04
		22/02/2019	< 0.1	< 0.1	7.3	7.3	78.9	0.2	1.19	0.03
		9/03/2018	0.0006	-	-	-	-	-	-	-
		11/04/2018	0.0002	-	-	-	-	-	-	-
		2/05/2018	0.0002	-	-	-	-	-	-	-
		12/06/2018	0.0003	-	-	-	-	-	-	-
		18/07/2018	0.0003	-	-	-	-	-	-	-
22	LFGMW2	1/08/2018	0.1	0.1	0.1	0.1	79.1	0.3	1013	-0.05
		14/08/2018	< 0.1	< 0.1	0.2	0.2	79.4	0.5	1017	0
		12/09/2018	< 0.1	< 0.1	0.1	0.1	79.3	0.1	1016	-0.05
		16/10/2018	< 0.1	< 0.1	4.1	4.1	83.2	0.4	10180	0.1
		26/11/2018	0	0	0.4	0.4	79.5	0.6	1003	0.07
		5/12/2018	< 0.1	< 0.1	6.4	6.4	82.1	0.3	1005	0.03
		16/01/2019	0	0	6.5	6.5	82.8	0	1006	0
		22/02/2019	0.1	0.1	2.6	2.6	811	0.3	1017	0.05
		9/03/2018	0.0004	-	-	-	-	-	-	-
		11/04/2018	0.00004	-	-	-	-	-	-	-
		2/05/2018	0.0003	-	-	-	-	-	-	-
		12/06/2018	0.0003	-	-	-	-	-	-	-
		18/07/2018	0.0004	-	-	-	-	-	-	-
23	LFGMW3	1/08/2018	< 0.1	0.1	2	2.1	79.4	0.2	1010	0
		14/08/2018	< 0.1	0.1	2.1	2.3	79.9	0.1	1014	0.07
		12/09/2018	< 0.1	< 0.1	2.4	2.4	79.5	0.2	1012	-0.05
		16/10/2018	< 0.1	< 0.1	3.6	3.6	80.4	0.04	1015	0.05
		26/11/2018	0	0	3.1	3.1	79.7	0.5	999	0.05
		5/12/2018	< 0.1	< 0.1	3.6	3.5	79.1	0.2	1005	0.05
		16/01/2019	0	0	4.2	4.2	81.9	0	1002	0.03
		22/02/2019	0.1	0.1	2.2	2.2	79.3	0.2	1014	0.03
		9/03/2018	0.0003	-	-	-	-	-	-	-
		11/04/2018	0.0001	-	-	-	-	-	-	-
		2/05/2018	0.0003	-	-	-	-	-	-	-
		12/06/2018	0.0003	-	-	-	-	-	-	-
		18/07/2018	0.0006	-	-	-	-	-	-	-
24	LFGMW4	1/08/2018	< 0.1	< 0.1	4.6	4.6	79.1	0.2	1009	-0.03
		14/08/2018	< 0.1	< 0.1	4.7	4.7	80	0	1013	-0.01
		12/09/2018	< 0.1	< 0.1	5.2	5.2	79.1	0.2	1012	0.07
		16/10/2018	< 0.1	< 0.1	4.5	4.5	79.6	0.4	1014	0
		26/11/2018	0	0	4.7	4.7	80.8	0.5	999	0.02
		5/12/2018	< 0.1	< 0.1	5.7	5.7	79.8	0.2	1001	0.02
		16/01/2019	0	0	3.4	3.4	81.9	-0.1	1001	-0.05
		22/02/2019	0.1	0.1	0.3	0.3	79.6	0.1	1013	0.02
		9/03/2018	0.0005	-	-	-	-	-	-	-
		11/04/2018	0.0005	-	-	-	-	-	-	-
		2/05/2018	0.0008	-	-	-	-	-	-	-
		12/06/2018	0.0005	-	-	-	-	-	-	-
		18/07/2018	0.0005	-	-	-	-	-	-	-
25	LFGMW5	1/08/2018	< 0.1	< 0.1	0.1	0.1	79.7	0	1009	0
		14/08/2018	< 0.1	< 0.1	5.4	5.4	80.6	0	1012	0.05
		12/09/2018	< 0.1	< 0.1	3.6	3.7	80.7	0.2	1011	0.05
		16/10/2018	< 0.1	< 0.1	3.4	3.4	80.6	0.4	1013	0
		26/11/2018	0	0	2.8	2.8	80.6	0.6	998	0.02
		5/12/2018	< 0.1	< 0.1	2.1	2.1	80.3	0.2	1000	0.07
		16/01/2019	0	0	2.5	2.5	81.9	0	1001	-0.03
		22/02/2019	0.1	0.1	0.3	0.3	79.8	0.2	1013	0.03
		9/03/2018	0.0006	-	-	-	-	-	-	-
		11/04/2018	0.0003	-	-	-	-	-	-	-
		2/05/2018	0.0003	-	-	-	-	-	-	-
		12/06/2018	0.0003	-	-	-	-	-	-	-
		18/07/2018	0.0006	-	-	-	-	-	-	-
26	LFGMW6	1/08/2018	0.1	0.1	0.1	0.1	79.3	0.2	1008	0.02
		14/08/2018	0.1	0.1	0.3	0.3	79.9	0	1012	0.07
		12/09/2018	0.1	0.1	0.4	0.4	80.1	0.2	1011	0.05
		16/10/2018	0.1	0.1	3.7	3.7	80.7	0.1	1013	0.03
		26/11/2018	0	0	1.9	1.9	80.6	0.6	997	0.03
		5/12/2018	0.1	0.1	0.1	0.1	79.7	0.2	1000	0.03
		16/01/2019	0	0	1.6	1.6	81.3	0	1001	-0.05
		22/02/2019	0.1	0.1	0.4	0.4	79.9	0	1013	0.03
		9/03/2018	0.0006	-	-	-	-	-	-	-
		11/04/2018	0.0010	-	-	-	-	-	-	-
		2/05/2018	0.0067	-	-	-	-	-	-	-
		12/06/2018	0.0023	-	-	-	-	-	-	-
		18/07/2018	0.0007	-	-	-	-	-	-	-
		1/08/2018	< 0.1	< 0.1	0.2	0.8	79.4	0.3	1009	0
27	LFGMW7	14/08/2018	< 0.1	< 0.1	0.2	1.2	80.1	0	1013	0

Table 1: **Subsurface Gas Results**
Client: Wollongong City Council

Monioing Point ID	Sample ID	Sample Date	CH4 % v/v	CH4 Peak % v/v	CO2 % v/v	CO2 peak % v/v	Bal %	Int Flow l/h	Baro mb	Relative Pressure mb
NSW EPA (2016) Solid Waste Landfills			1 % v/v	1 % v/v	1.5 % v/v	1.5 % v/v				
		12/09/2018	< 0.1	< 0.1	0.4	2.2	79.9	0.3	1011	0.07
		16/10/2018	< 0.1	< 0.1	1.3	2.6	80.1	0.1	1014	0.05
		26/11/2018	0	0	0.5	1.8	80.5	0.6	998	0.02
		5/12/2018	< 0.1	< 0.1	0.2	1.3	79.5	0.2	1000	0.1
		16/01/2019	0	0	0.3	2.4	81.3	0	1002	0.01
		22/02/2019	0.1	0.1	0.1	0.1	80	0.3	1014	0.02
		9/03/2018	0.0	-	-	-	-	-	-	-
		11/04/2018	0.0	-	-	-	-	-	-	-
		2/05/2018	0.0013	-	-	-	-	-	-	-
		12/06/2018	0.0011	-	-	-	-	-	-	-
		18/07/2018	0.0009	-	-	-	-	-	-	-
		1/08/2018	< 0.1	< 0.1	0.3	0.5	79.9	0.3	1009	-0.03
28	LFGMW8	14/08/2018	< 0.1	< 0.1	0.3	0.4	79.9	0.1	1013	0.03
		12/09/2018	0.1	0.1	0.3	0.4	80.5	4.5	1012	0.1
		16/10/2018	< 0.1	< 0.1	2.3	2.3	80.5	8.5	1014	0
		26/11/2018	0	0	0.3	0.7	80.5	0.1	998	0.02
		5/12/2018	< 0.1	< 0.1	1.2	1.6	79.9	6.6	1001	0.12
		16/01/2019	0	0	1.6	1.6	80.4	-0.3	1002	0
		22/02/2019	0.1	0.1	0.1	0.1	79.6	4.1	1013	-0.02
		9/03/2018	0.00012	-	-	-	-	-	-	-
		11/04/2018	0.0050	-	-	-	-	-	-	-
		2/05/2018	0.0021	-	-	-	-	-	-	-
		12/06/2018	0.0012	-	-	-	-	-	-	-
		18/07/2018	0.0004	-	-	-	-	-	-	-
		1/08/2018	< 0.1	< 0.1	1.5	1.5	80	0.4	1010	0
29	LFGMW9	14/08/2018	< 0.1	< 0.1	0.1	1.1	79.9	0.2	1013	0.02
		12/09/2018	< 0.1	< 0.1	1.8	1.9	81.1	0.2	1012	0.09
		16/10/2018	< 0.1	< 0.1	2.6	2.6	82.9	10.1	1014	0
		26/11/2018	0	0	3.4	3.4	79.8	0.4	998	0.02
		5/12/2018	< 0.1	< 0.1	5.3	5.3	80.9	0.1	1001	0.03
		16/01/2019	0	0	5	5	82.7	0.2	1002	0.02
		22/02/2019	0.1	0.1	6.5	6.6	78.1	0.3	1014	0.03
		9/03/2018	0.0011	-	-	-	-	-	-	-
		11/04/2018	0.0003	-	-	-	-	-	-	-
		2/05/2018	No Access	-	-	-	-	-	-	-
		12/06/2018	No Access	-	-	-	-	-	-	-
		18/07/2018	No Access	-	-	-	-	-	-	-
		1/08/2018	< 0.1	< 0.1	1.1	1.2	79	0.3	1010	0.02
30	LFGMW10	14/08/2018	< 0.1	< 0.1	1.4	2.1	79.8	0.3	1012	0.01
		12/09/2018	< 0.1	< 0.1	0.8	0.8	80.3	0.2	1012	0.07
		16/10/2018	< 0.1	< 0.1	1.9	1.9	80.5	0.1	1014	0.02
		26/11/2018	0	0	3.5	3.5	81.4	6	999	0.02
		5/12/2018	< 0.1	< 0.1	5.3	3.3	-	0.1	1001	0.07
		16/01/2019	0	0	4.3	4.3	82.3	0.1	1003	0.02
		22/02/2019	0.1	0.1	3.8	3.9	78.5	0.1	1014	0.05
		9/03/2018	0.0009	-	-	-	-	-	-	-
		11/04/2018	No Access	-	-	-	-	-	-	-
		2/05/2018	No Access	-	-	-	-	-	-	-
		12/06/2018	No Access	-	-	-	-	-	-	-
		18/07/2018	No Access	-	-	-	-	-	-	-
		1/08/2018	< 0.1	< 0.1	4.4	4.9	80.4	0.3	1010	-0.02
31	LFGMW11	14/08/2018	< 0.1	< 0.1	8	8.2	82.9	0.3	1013	0.02
		12/09/2018	< 0.1	< 0.1	10.8	10.8	84.6	0.2	1013	0.03
		16/10/2018	< 0.1	< 0.1	9.3	9.3	81.1	0.1	1013	0.03
		26/11/2018	0	0	7.3	7.3	82.9	0.6	999	0.02
		5/12/2018	< 0.1	< 0.1	8.7	8.7	84.7	0.2	1001	0.03
		16/01/2019	0	0	9.8	9.8	85.3	0.2	999	-0.05
		22/02/2019	0.1	0.1	14.9	15	83.5	0.1	1015	0
		9/03/2018	0.0005	-	-	-	-	-	-	-
		11/04/2018	No Access	-	-	-	-	-	-	-
		2/05/2018	No Access	-	-	-	-	-	-	-
		12/06/2018	No Access	-	-	-	-	-	-	-
		18/07/2018	No Access	-	-	-	-	-	-	-
		1/08/2018	0.1	0.1	10.6	10.7	82.5	0.3	1011	-0.02
32	LFGMW12	14/08/2018	0.1	0.1	10.6	10.6	84.6	0.2	1013	0.05
		12/09/2018	0.1	0.1	8.6	8.6	87.6	0.3	1013	0
		16/10/2018	0.1	0.1	7.3	7.3	91.3	0.4	1013	0.09
		26/11/2018	0	0	12.3	12.3	84	0.5	999	0.02
		5/12/2018	0.1	0.1	9.2	9.2	84	0.2	1002	0.07
		16/01/2019	0	0	10.4	10.4	84.7	0.2	1002	0.03
		22/02/2019	0.1	0.1	13.5	13.5	81.7	0.1	1015	0.03

Table 2: **Accumulation into Buildings**
Client: Wollongong City Council

Location	Sample No.	Date											
		9/03/2018	11/04/2018	2/05/2018	12/06/2018	18/07/2018	14/08/2018	13/09/2018	16/10/2018	27/11/2018	19/12/2018	16/01/2019	22/02/2019
NSW EPA (2016) Solid Waste Landfills, Surface Emissions		1% v/v											
SWERF	1	-	-	-	No Access	-	0.00014	0.00019	0.00023	No Access	No Access	No Access	No Access
	1				No Access	-	0.00015	0.00020	0.00024	No Access	No Access	No Access	No Access
Weighbridge	1	0.00016	0.00044	0.00024	0.00019	0.00018	0.00016	0.00024	0.00026	0.00024	0.00021	0.00021	0.00019
Glengarry Cottage	Manager office	0.00013	0.00017	0.00022	0.00025	0.00021	0.00019	0.00025	0.00024	0.00026	0.00021	0.00021	0.00019
	Front Office	0.00012	0.00018	0.00023	0.00027	0.00023	0.00021	0.00025	0.00024	0.00025	0.00021	0.00021	0.00019
	Meeting Room	0.00011	0.00016	0.00021	0.00023	0.00018	0.00022	0.00025	0.00024	0.00025	0.00021	0.00021	0.00019
	Operations Room	0.00013	0.00018	0.0002	0.00024	0.00018	0.00022	0.00025	0.00024	0.00024	0.00021	0.00021	0.00019
Glengarry Cottage	Kitchen	0.00016	0.00018	0.00022	0.00022	0.00021	0.00021	0.00025	0.00024	0.00025	0.00021	0.00021	0.00020
	hallway	0.00013	0.00016	0.00023	0.00023	0.00021	0.00022	0.00025	0.00024	0.00025	0.00021	0.00021	0.00020
	Store	0.00013	0.00017	0.00020	0.00023	0.00018	0.00022	0.00025	0.00024	0.00025	0.00021	0.00021	0.00019
	Max reading gardens	0.00015	0.00015	0.00021	0.00021	0.00025	0.00021	0.00025	0.00024	0.00022	0.00022	0.00021	0.00020

Table 3: Surface Gas Results
Client: Wollongong City Council

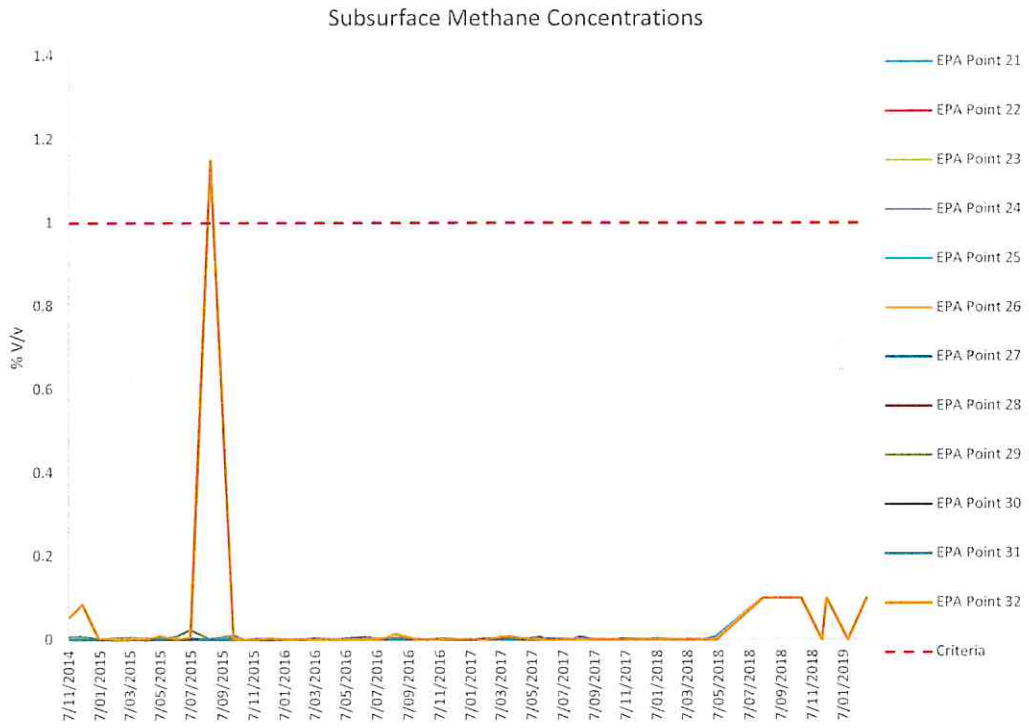
Transect	Sample No.	Date											
		9/03/2018	11/04/2018	2/05/2018	12/06/2018	18/07/2018	14/08/2018	13/09/2018	16/10/2018	27/11/2018	19/12/2018	16/01/2019	22/02/2019
NSW EPA (2016) Solid Waste Landfills, Surface Emissions		500 ppm											
1	1	No acceess	3	No access	2.2	3.3	2	-	-	2.5	-	No access	8.9
	2				2.9	2.8	1.7	-	-	2.5	-	-	9.5
	3				4	3.5	1.6	-	-	2.5	-	-	10
2	1	3	3	5	-	-	-	2	No Access	No Access	No Access	No access	No access
	2	5		6	-	-	-	2	No Access	No Access	No Access	No access	No access
	3	6		6	-	-	-	2.1	No Access	No Access	No Access	No access	No access
	4	6			-	-	-	2.2	No Access	No Access	No Access	No access	No access
	5	2	4						No Access	No Access	No Access	No access	No access
3	1	5	6	6	2.1	4.8	2.7	2.1	No Access	2.5	-	2.1	5.7
	2	9	5	6	2.7	4.4	2.4	2.1	No Access	2.5	-	2.0	6.4
	3	4	5	6	2.3	3.4	2.2	2.1	No Access	2.5	-	2.0	7.3
	4	4	5	7	7.3	3	2.2	2	No Access	2.5	-	2.0	6.7
	5	5			-	3.2	2.4	2.1	No Access	2.5	-	2.0	8.7
4	No Results											No access	No access
5	1	4	8	13	12.5	7.9	2.6	2.3	No Access	2.6	-	2.4	13
	2	3	5	9	9.6	5.8	1.9	2.6	No Access	26	-	2.3	11.5
	3	4	6	12	6.6	4.5	2	2.2	No Access	2.7	-	2.3	7.1
	4	7	5	28	10.6	5.3	2.8	2.3	No Access	2.6	-	2.2	7.8
	5	11	5	10	-	6.2	2.4	2.3	No Access	3.3	-	2.1	10.3
	6	6			-	4.4	2.2	2.2	No Access	4.4	-	-	16.2
6	1				-	-	-	-	-	No Access	No Access	No access	
7	1	2	10	6	10.9	6.9	3.2	2.1	No Access	2.6	-	4.4	10.2
	2	3	9	6	7.8	4.8	2.8	2.3	No Access	2.6	-	2.6	14.7
	3	2	11	5	11.5	10.9	1.8	2.1	No Access	2.9	-	2.3	11.2
	4	2	6	5	8.3	6.4	3.5	2.3	No Access	2.7	-	2.5	18.5
	5	2	7	36	5.4	3.8	4.1	2.3	No Access	2.6	-	3.7	30.8
	6	3			-	4.3	-	2.5	No Access	-	-	2.5	32.3
8	1				-	-	8.6	-	-	-	-	No access	22.7
	2				-	-	7.3	-	-	-	-	No access	22.1
	3				-	-	4.3	-	-	-	-	No access	14.9
	4				-	-	3.1	-	-	-	-	No access	13.6
	5				-	-	3	-	-	-	-	No access	11.4
	6				-	-	2.1	-	-	-	-	No access	
9	1				-	-	-	-	-	2.4	2.6	2.3	No access
	2				-	-	-	-	-	2.4	2.1	2.2	No access
	3				-	-	-	-	-	2.6	2.3	2.2	No access
	4				-	-	-	-	-	2.8	2.2	2.3	No access
	5				-	-	-	-	-	2.4	2.2	2.6	No access
	6				-	-	-	-	-	2.3	3	2.6	No access
10	1	2	9	7	9.2	2.6	2	11	9.1	5.7	2	4	8
	2	6	45	13	6	3.4	1.9	9.9	11.1	2.8	2.1	3.2	14
	3	1	50	10	2.8	8.2	2.3	11.4	5.9	7.3	1	2.4	12
	4	2	19	26	32	6.9	3.7	2.7	4.3	15.2	1.9	4.3	17
	5	4	31	13	21.3	9.6	1.7	2.7	6.3	4.8	15.8	11.1	9.9
	6	18	15	33	17.2	8.1	2.3	11.6	4.7	24.8	5.2	10.2	10.5
	7	10	24	18	13.1	6.4	2.8	5.5	4.1	17.8	6.4	5.6	11
	8	12	100	16	36.9	6.3	3.9	13	9	12.3	4.5	2.6	18
	9	19	10		14.8	5.2	11.8	3	3.5	3.7	2	3.4	17
	10	12			-	3.2	10.6	4.7	3.9	-	2.3	3.9	10
	11	2			-	2.3	11.2	2.7	-	-	2.9	-	5.5
	12	13			-	2.3	10.7	4.3	-	-	2.7	-	4.6
	13	20			-	2.5	11.4	2.8	-	-	-	-	6.1
	14	20			-	2.2	13.2	3.9	-	-	-	-	
	15	11			-	5	12.4	-	-	-	-	-	
	16				-	-	10.9	-	-	-	-	-	
	17				-	-	6.4	-	-	-	-	-	
10 Methane Cage												3.9	
11	No Results											-	
A	1	2	1	3	2	1.4	1.8	1.6	2.1	2.9	28	2.3	2.4
	2	2	2	4	2.4	1.5	2	1.5	2.2	2.5	2.1	2.3	2.3
	3	2	2	4	2	1.9	1.9	1.4	2.2	2.5	2.1	2.3	2.3
	4		1	4	5.3	2	1.9	1.4	2.3	2.6	2.1	2.3	2.3
	5		1	4	2.3	1.6	1.9	1.3	-	2.8	2	2.3	2.3
B	1				No Access	-	-	-	-	-	-	No access	No access
C	1	2	1	4	1.9	-	1.8	1.6	2.3	2.4	2.2	2.3	2.4
	2	2	1	4	2	-	1.8	1.7	2.4	2.4	2.7	2.3	2.4
	3	2	1	4	2	-	1.8	1.6	2.4	2.6	2.5	2.4	2.3
	4	2	2	4	2.3	-	1.5	1.4	2.4	2.7	2	2.4	2.3
	5	2	5	10	2.3	-	1.7	1.4	2.5	-	1.8	2.6	2.3
	6	2	2	3	3	-	1.6	1.5	2.5	2.5	2.1	2.7	2.3
	7	2	2	6	3	-	1.4	1.4	2.3	3.9	8.4	2.6	2.3
	8	2	2	27	2.6	-	1.4	1.4	2.2	2.5	8.6	3.1	2.3
	9	3	2	19	4.2	-	1.7	1.3	2.1	-	3.6	11.5	2.3
	10	2	2	9	3.7	-	1.5	2	2.6	-	9.6	4.1	2.3
	11			10	-	-	1.3	2	2.1	-	-	-	
	12				-	-	-	2.4	-	-	-	-	
	13				-	-	-	4.4	-	-	-	-	
D	1	1	2	1	2.1	2.3	1.5	2.3	2.1	2.5	2	2.1	2.2
	2	1	2	1	2.3	2.3	1.2	2.3	2.2	2.4	2.1	2.1	2.2
	3	1	2	1	2.1	2.5	1.4	2.3	2.4	2.5	2.3	2.1	2.1
	4	2	2	1	2	2.4	1.3	2.3	2.6	3.5	2.8	2.1	2.1
	5	2	4	1	2.1	2.4	1.2	2.3	2.4	2.5	2.4	2.1	2.2
	6			1	-	2.3	1.5	-	-	-	2.7	2.1	2.2
	7				-	-	1.3	-	-	-	2.7	-	2.2
E	1	2	2	2	8.2	2.2	1.6	2.9	2.4	2.5	5.5	2.5	2.1
	2	2	2	2	3.2	2.3	1.5	2.8	2.4	2.5	5.1	3.4	2.2
	3	2	2	2	2.7	2.5	1.6	2.5	2.3	2.5	6	2.5	2.1
E- Methane cage	4	2	2	1	2.5	2.4	1.4	2.5	2.2	2.5	2.4	2.8	2.2
E	5	3	3	2	2.5	2.5	1.4	2.5	2.2	2.6	2.1	2.3	2.1
	6	2	3	2	2.6	2.5	1.4	2.5	2.2	2.4	1.9	2.2	2.2
	7	2	2	1	2.3	2.6	1.5	2.3	-	2.4	1.9	2.1	2.2
F - Methane cage	1	2	2	2	2	2	1.4	2.1	2.4	2.3	2.7	-	
F	2	2	2	2	2.3	2	1.2	2.1	2.5	2.3	2.7	2.1	2
	3	2	2	2	2.1	2	1.6	2.1	2.5	2.3	2.4	2.1	2.1
	4	2	2	2	2.5	2.1	1.5	2.1	2.5	2.7	2.7	2.1	2
	5	2	2	2	2.5	2.1	1.4	2.1	2.4	2.6	2.5	2.0	2
	6	2	2	3	2.3	2.3	1.4	2.1	2.4	4.4	5.2	2.0	2
	7	3	3	2	3.2	2.2	1.4	2.1	2.4	3.1	3.5	2.5	2
F- Methane cage	8	3	2	2	3.2	2.4	1.4	2.4	-	3.3	5	-	-

Table 3: Surface Gas Results
Client: Wollongong City Council

Transect	Sample No.	Date											
		9/03/2018	11/04/2018	2/05/2018	12/06/2018	18/07/2018	14/08/2018	13/09/2018	16/10/2018	27/11/2018	19/12/2018	16/01/2019	22/02/2019
NSW EPA (2016) Solid Waste Landfills, Surface Emissions		500 ppm											
F	9											2.4	2
	10											2.2	2
G	1	2	2	3	2.4	1.9	1.5	2.1	2.4	2.3	2.5	2.2	2.0
	2	2	2	3	2.3	2	1.6	2.2	2.5	2.3	2.6	2.3	2.0
G - Methane cage	3	2	2	3	2.3	2	1.6	2.2	2.5	2.3	2.5	2.1	2.1
G - Methane cage	4	3	2	3	2.4	1.8	1.9	2.1	2.5	2.7	2.7	-	-
G	5	2	2	2	2.5	2.6	1.7	2.1	-	2.6	2.2	2.3	2.0
	6	3	2	2	2.3	2.4	1.5	2.3	-	4.4	2.5	2.3	2.1
	7	3	25	2	2.5	2.2	1.5	2.2	-	3.1	2.1	2.1	2.2
	8				-	-	1.5	2.2	-	3.3	-	2.1	2.5
	9				-	-	1.4	-	-	-	-	2.8	
H- Methane cage	1	2	2	9	2.2	1.8	0.8	2	2.6	4.4	2.4	3.8	2.3
H	2	2	2	2	2.8	1.6	1.1	2.1	2.1	5.4	3.3	2.7	2.3
	3	2	5	1	4.8	1.9	1.2	2.2	2.3	5.3	2.6	2.3	2.3
H- Methane cage	4	2	2	6	3.5	2.1	1.3	2.2	2.2	3.2	2.7	2.4	2.1
H	5	2	2	4	2.3	2	1.7	2.3	2.2	3	2.8	3.6	2.1
	6	2	1	3	2.3	2	1.7	2.7	2.3	4.1	2.3	3.0	2.0
	7				-	1.9	-	-	-	-	-	-	
I	1	1	5	3	2.5	2.3	1.3	2.3	2	2.9	2.8	2.1	2
	2	1	2	2	2.4	2.5	1.5	2.3	2.1	3.3	3.2	2.1	2
	3	1	2	1	1.9	2.5	1.5	2.3	2.1	4.3	3.3	2.2	1.9
	4	1	2	2	2	2.6	1.5	2.5	2.1	3.1	3	2.2	1.9
	5	5	2	2	1.8	2.4	1.6	2.5	10.5	3.3	2.9	2.4	1.9
	6	6	2	4	2.2	2.3	1.1	2.4	2.8	3.3	5	2.9	1.9
	7				-	-	0.8	-	-	-	-	-	
J	1				No Access	2.4	1.4	2.4	2.1	3	2.8	6.3	No Access
	2				No Access	2.4	1.3	2.4	2.4	2.4	2.9	2.9	No Access
	3				No Access	2.5	1.2	2.6	2.6	2.3	2.9	2.4	No Access
	4				No Access	2.4	-	2.6	2.6	2.4	5	-	No Access
	5				No Access	-	-	2.7	-	2.4	3.1	-	No Access
K	1				No Access	2.2	1.6	-	2.4	2.5	No Access	3.3	No Access
	2				No Access	2.3	1.7	-	2.6	2.5	No Access	5.0	No Access
	3				No Access	2.3	1.9	-	2.5	2.4	No Access	2.8	No Access
	4				No Access	2.4	1.5	-	2.5	-	No Access	2.4	No Access
	5				No Access	2.7	1.6	-	2.6	-	No Access	2.4	No Access
	6				No Access	2.2	1.7	-	2.6	-	No Access	-	No Access
	7				No Access	-	1.6	-	2.5	-	No Access	-	No Access
	8				No Access	-	1.5	-	2.2	-	No Access		No Access
L	1				No Access	2.3	-	3.3	-	2.6	No Access	2.3	No Access
	2				No Access	-	-	3.5	-	2.5	No Access	2	No Access
	3				No Access	-	-	2.7	-	4.5	No Access	2.1	No Access
	4				No Access	-	-	3.6	-	3	No Access	5.3	No Access
	5				No Access	-	-	3.5	-	2.5	No Access	2.8	No Access
	6				No Access	-	-	6.2	-	2.6	No Access	2.8	No Access
	7				No Access	-	-	2.6	-	-	No Access		No Access
M	1				No Access	-	-	No Access	-	No Access	2.8	No Access	No Access
	2				No Access	-	-	No Access	-	No Access	2.8	No Access	No Access
	3				No Access	-	-	No Access	-	No Access	3.5	No Access	No Access
	4				No Access	-	-	No Access	-	No Access	2.6	No Access	No Access
	5				No Access	-	-	No Access	-	No Access	2.6	No Access	No Access
	6				No Access	-	-	No Access	-	No Access	5.3	No Access	No Access
N	1				No Access	-	-	-	-	No Access	2.7	No Access	No Access
	2				No Access	-	-	-	-	No Access	2.7	No Access	No Access
	3				No Access	-	-	-	-	No Access	2.6	No Access	No Access
	4				No Access	-	-	-	-	No Access	2.3	No Access	No Access
	5				No Access	-	-	-	-	No Access	2.5	No Access	No Access
	6				No Access	-	-	-	-	No Access	2.5	No Access	No Access
181 Reddalls Rd Fenceline	1	1.8	1.8	2.5	1.9	1.9	1.1	2.5	2.5	2.5	2.3	2.4	1.9
	2	2.3	2.1	2.3	2.1	1.9	1	2.4	2.6	2.6	2.1	2.3	2
	3	2.7	1.9	2.3	2.1	2	8	2.4	2.4	2.7	2	2.3	2
	4	2.8	2	2.3	2.2	1.92	1.3	2.4	2.6	2.6	1.8	2.4	1.9
	5	1.7	1.9	2.2	2.2	2	1.4	2.5	2.5	2.7	1.8	2.3	1.9
	6	1.4	2	2.2	2.1	2	1.5	2.4	2.5	2.8	1.8	2.3	1.9
	7	1.8	2	2.2	2.4	2	1.2	2.4	2.6	2.7	1.8	2.4	1.9
	8	1.9	0	2	No Access	2	1.1	2.5	2.6	2.6	1.8	2.5	1.9
181 Reddalls Rd- Garden	1	1.3	1.8	2	2.1	2.4	1.2	No Access	No Access	2.5	1.8	0	0
Lot 1 Farmborough Fenceline	1	0.9	2.3	2.6	2.3	2.4	1.3	2.6	No Access	No Access	2.2	2.4	2.9
	2	1	2.3	2.5	2.1	1.8	1.3	2.7	No Access	No Access	2.2	2.4	3
	3	1.2	2.3	2.3	2.1	1.8	1.1	2.7	No Access	No Access	2.3	2.1	2.8
	4	1.1	2.6	2.2	2.1	2.1	1.4	2.5	No Access	No Access	2.5	2.1	3.1
	5	1.4	1.9	2.6	1.9	2.1	1.2	2.3	No Access	No Access	2.1	2.2	3.3
	6	1.6	2.3	2.8	2.2	2.4	1.3	2.3	No Access	No Access	2.1	2.1	3.4
	7	1.2	2.2	2.5	2.1	2.5	1.4	2.3	No Access	No Access	2.1	2.2	2.9
	8	No acceess	2.2	2.5	2.2	No Access	1.5	2.1	No Access	No Access	2.1	2.1	3
Lot 1 Farmborough Gardens	1	No acceess	No Access	2	1.9	No Access	No Access	2	No Access	No Access	2.1	0	3.4
Recycle/Revolve East	-				-	-	1.4	2.4	2.6	-	2.1	2.1	2.4
Recycle/Revolve West	-				-	-	1.2	2.4	2.4	-	2.0	2.0	2.4

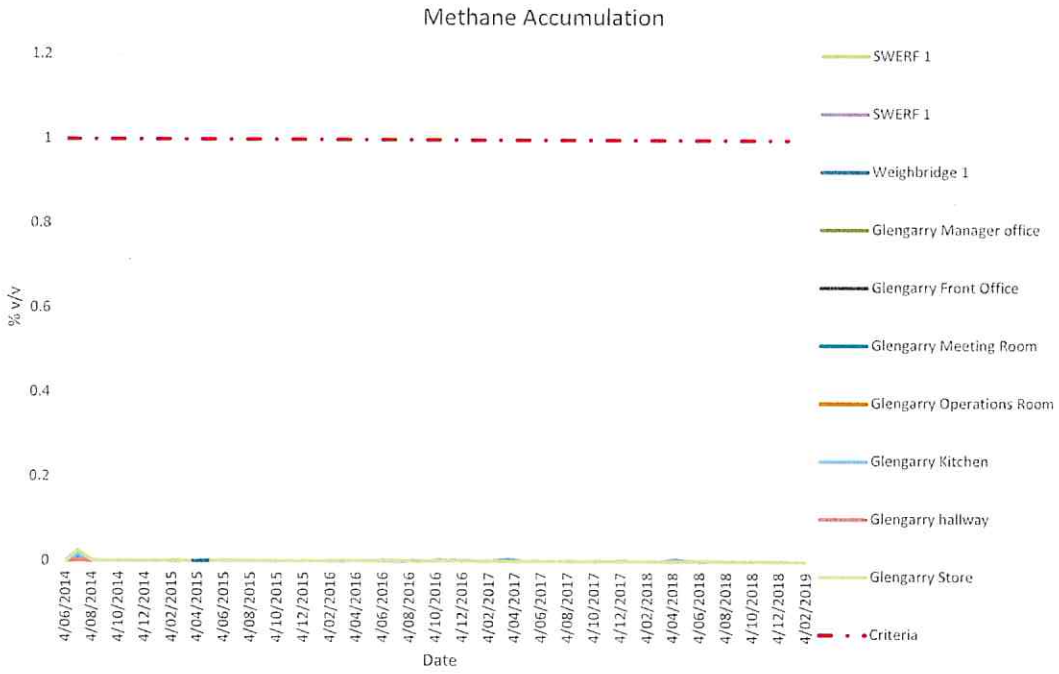
Whytes Gully

Gas



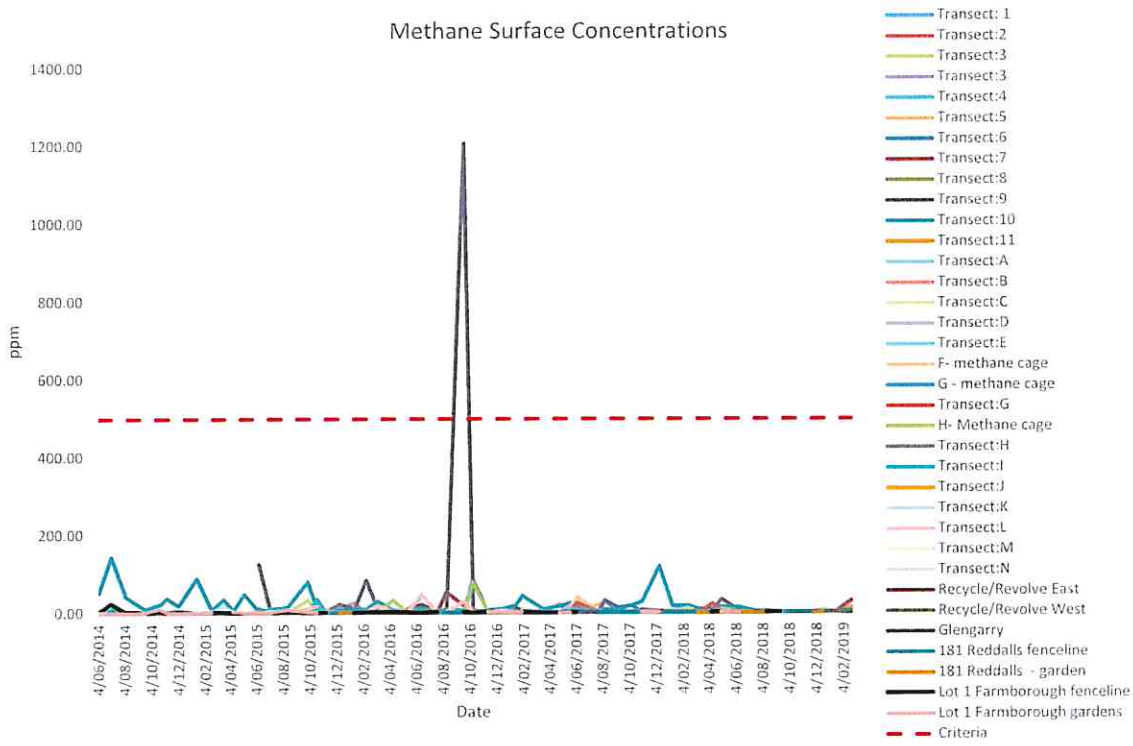
Whytes Gully

Gas



Whytes Gully

Gas



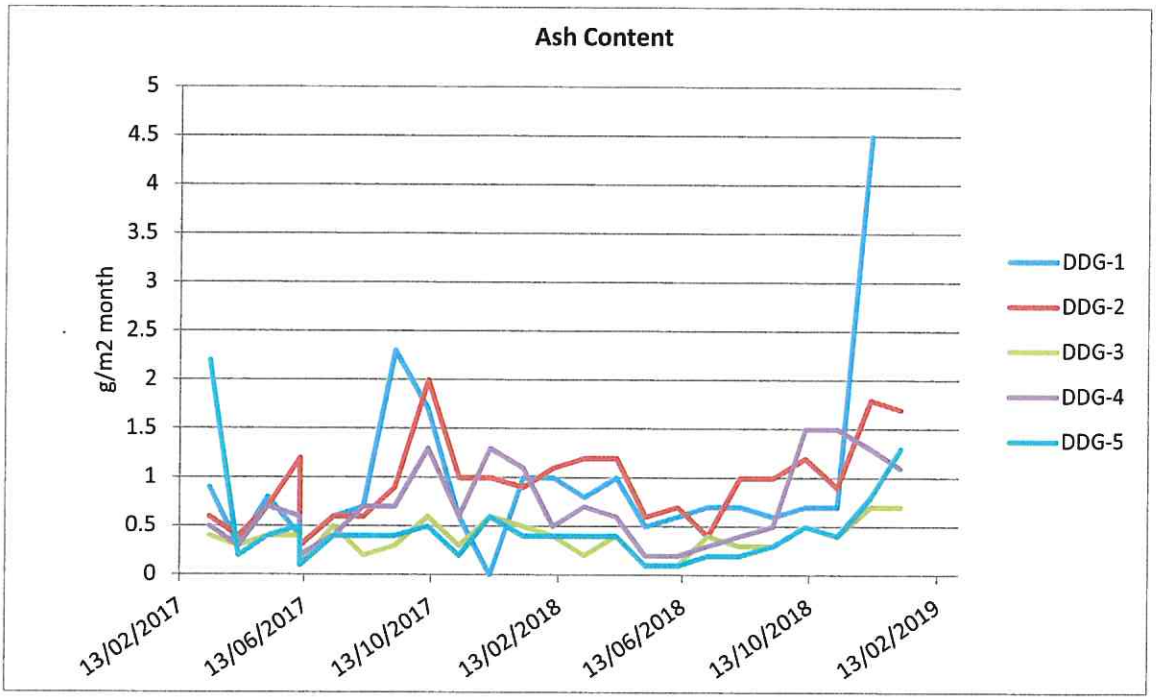
Appendix F: Dust: Tabulated Results and Trends

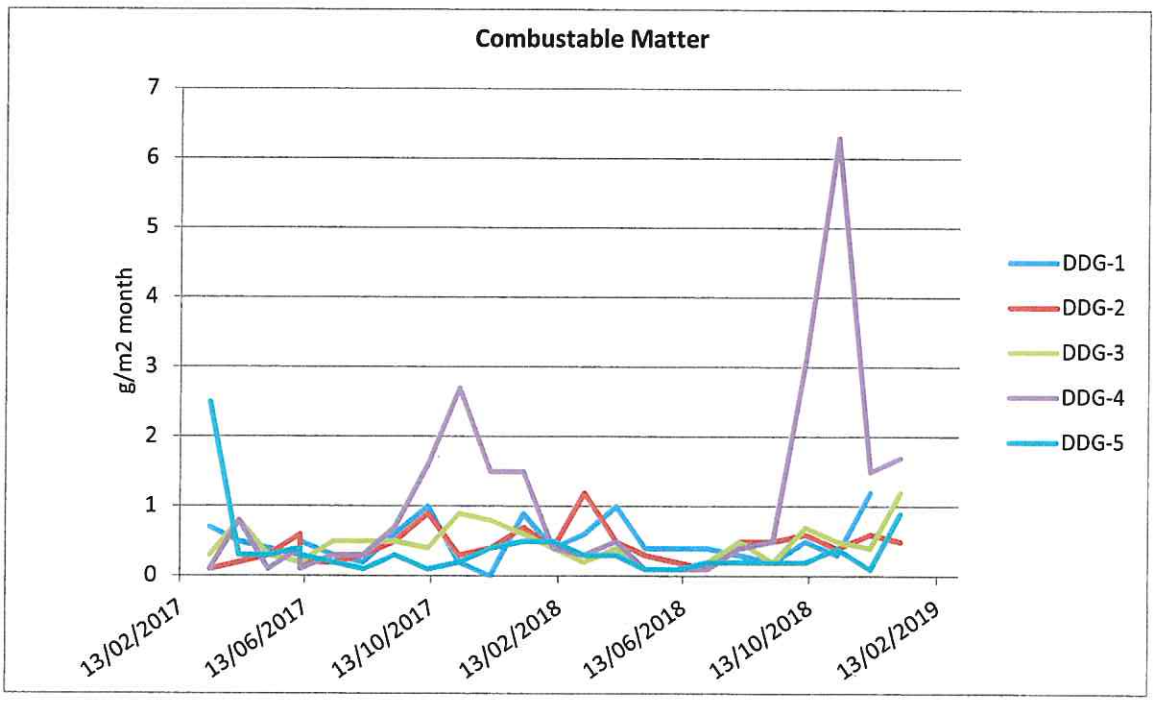
Table 1: **Respirable Dust Results**
Client: Wollongong City Council

Sample ID	Sample Date	Total Suspended Particulates	PM10	Total Suspended Particulates (mass per filter)	PM10 (mass per filter)
		µg/m3	µg/m3	mg/filter	mg/filter
PQL		0.1	0.1	0.1	0.1
EPL 5862 Dust Generation Criteria	Annual Average	90	30		
	24hr Average		50		
DDG-1 - Whytes Gully	19/03/2018	35.7	20.4	54.4	30.6
	24/04/2018	40	17.2	60.5	24.4
	21/05/2018	25	10.4	38.2	15.9
	20/06/2018	8.7	4.3	13.7	6.6
	19/07/2018	36.3	15.6	55.9	23.7
	21/08/2018	102.0	35.9	157.0	54.4
	17/09/2018	45.0	26.3	67.9	39.1
	15/10/2018	15.7	9.8	24.1	14.8
	27/11/2018	35.7	16.7	52.8	24.4
	17/12/2018	21.7	44.2	31.9	63.2
	15/01/2019	92.9	39.2	137.0	57.0
	20/02/2019	36.5	8.4	54.4	12.3
	Annual Average	**41.3**	**20.7**	**62.3**	**30.5**
DDG-2 - Glengarry Cottage	19/03/2018	92.4	52	137	78.5
	24/04/2018	50.5	17.3	76.1	26.6
	21/05/2018	40	10	62	15.4
	20/06/2018	28.2	11.5	44.5	17.8
	19/07/2018	65.7	39.8	101.0	60.1
	20/08/2018	31.4	11.8	47.7	17.5
	17/09/2018	67.2	25.0	103.0	37.7
	16/10/2018	33.0	19.1	50.0	28.5
	28/11/2018	7.1	4.2	10.7	6.2
	17/12/2018	80.2	39.7	119.0	58.1
	15/01/2019	77.5	40.6	114.0	58.9
	18/02/2019	89.0	42.9	132.0	63.4
	19/03/2019	16.8	15.2	25.3	22.5
	14/05/2019	43.8	17.7	68.3	27.1
	Annual Average	**51.6**	**24.8**	**77.9**	**37.0**

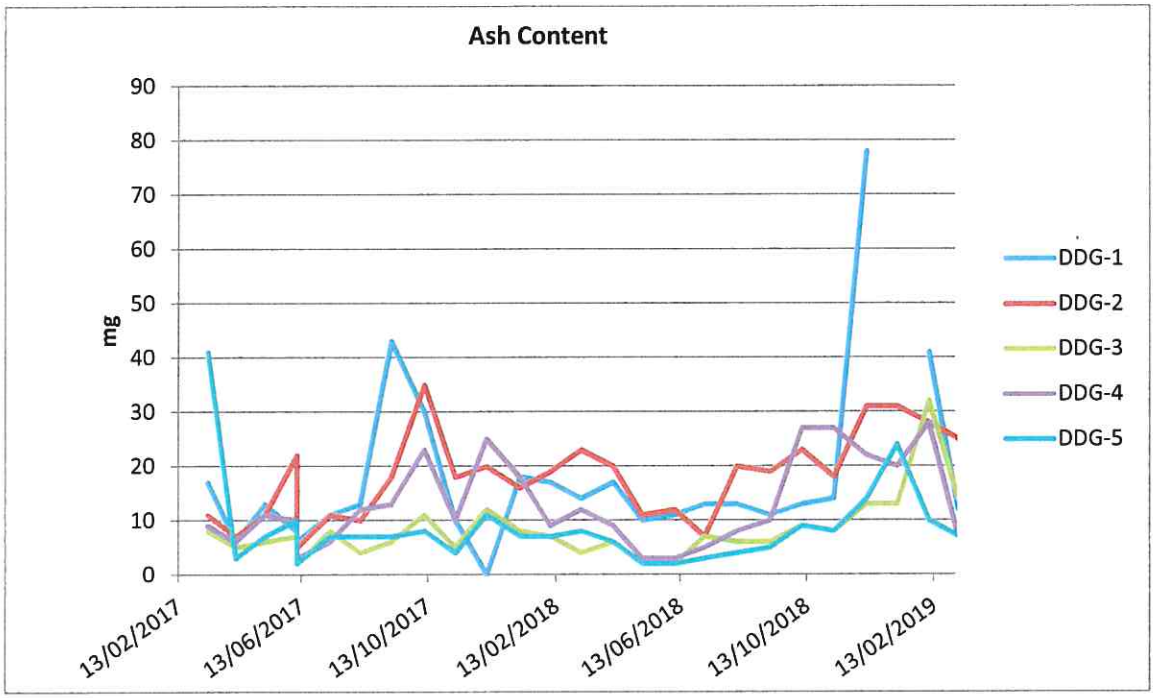
Whytes Gully

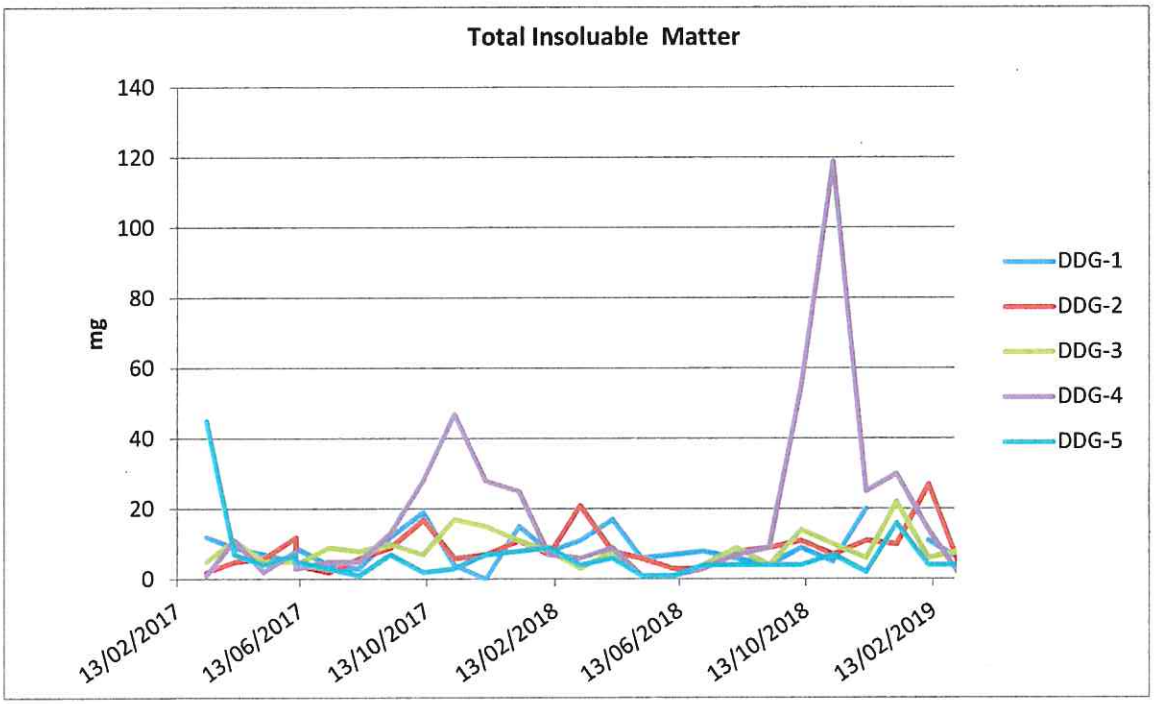
Dust





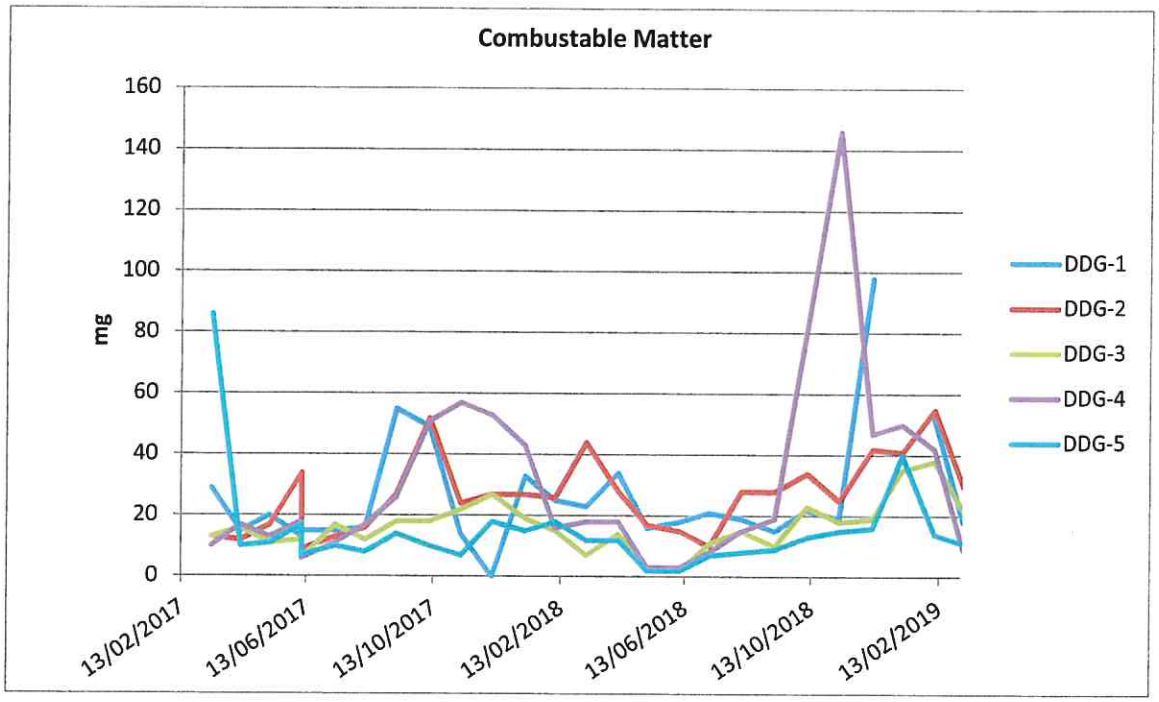
Whytes Gully Dust

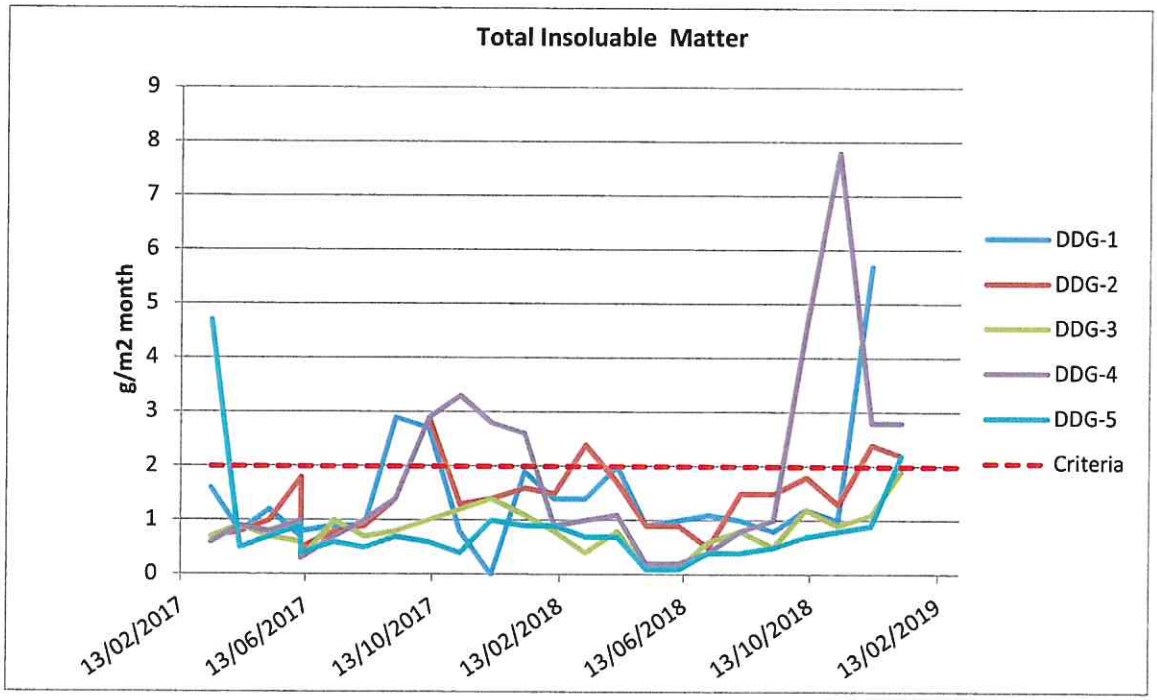




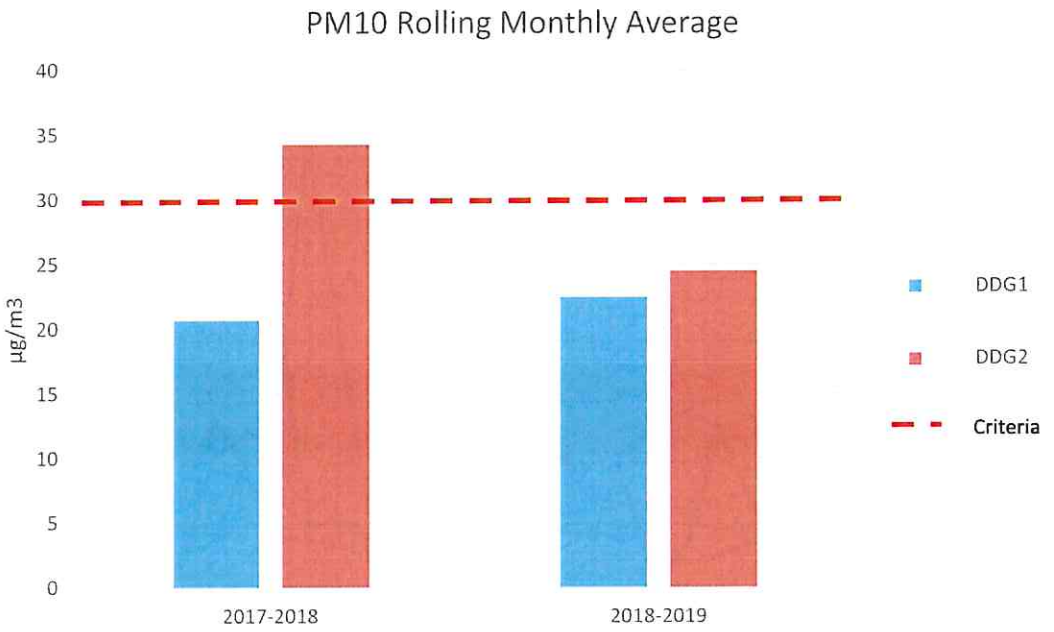
Whytes Gully

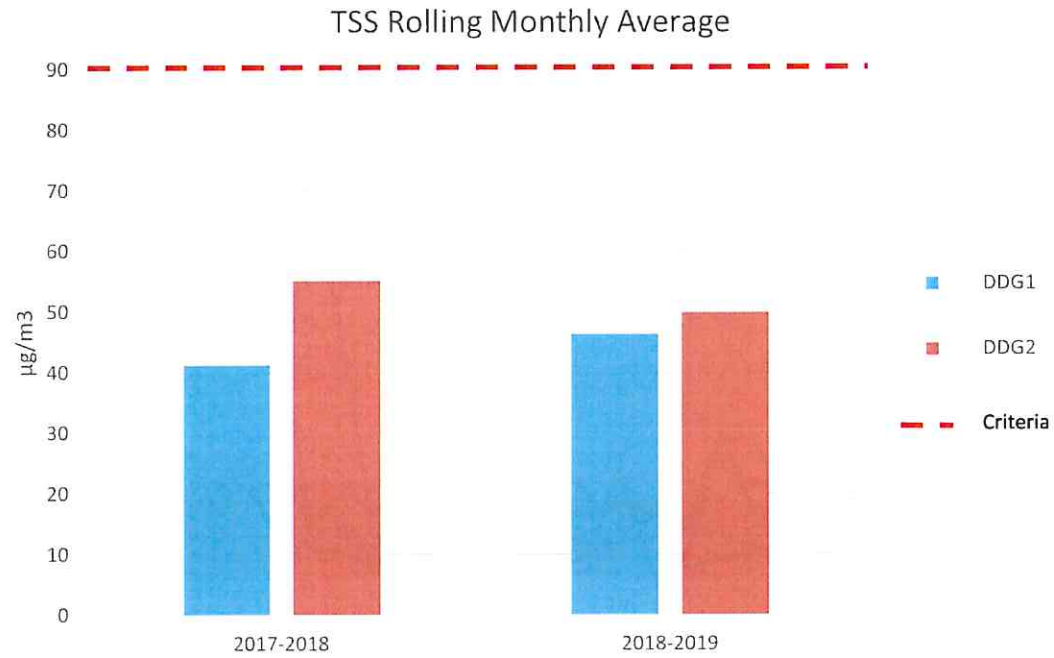
Dust





Whytes Gully Dust





Appendix G: Odour Log and Complaints

WASTE SERVICES - ODOUR INSPECTON/DIAGNOSTIC LOG - observations that may assist in tracking down the source of a smell or odor

For each observation note the status of odour factors listed in order to correlate presence or absence of an odour or smell with other conditions

Date	Time	Location	Observation	Odour Character & Intensity	odour intensity	Weather Conditions	Comments	Control/Corrective Action	Date Implemented	Inspected By	Public/EPA Complaint enter date /trim no
	Time of Day & Observation	List each location	Observed odour/smell, YES/NO	Describe the odor and its strength	0. No odour 1. Very Faint Odour 2.Faint Odour 3. distinct odour 4. Strong Odour 5. Very Strong Odour	Temperature (very warm, warm, mild , cold) wind strength (none, light, steady, strong, gusting) wind direction (eg from NE), humidity, rain, Sunny, cloudy etc.					
12/03/2018	11.00am	WWARRO	yes	slight odour observed north of tip face on entry to tip face		mild. Sw slight wind	DK - Investigated Highview Dr and Fairloch Ave Farmb Hts - no odour detected 11.30am 12/3/2018			Della	20/3/2018 Z18
23/03/2018	10.30am	Whytes commercial tip face	Yes (Matt Jamieson & Mick Chaplin)	garbage smell	3	Raining/overcast SW gentle breeze	Odour observed by Matt Jamieson and Mick Chaplin. Due to SW light wind at the time, Mick re started the de odouriser. Operational between 10.30am to 2.00pm. Re assessed and conditions had improved. No odour detected and deodouriser was shut down	Deodouriser operational between 10.30 -2.00pm.		Mick Chaplin	NA 23/3/2017 Z17/73642

WASTE SERVICES - ODOUR INSPECTON/DIAGNOSTIC LOG - observations that may assist in tracking down the source of a smell or odor

For each observation note the status of odour factors listed in order to correlate presence or absence of an odour or smell with other conditions

Date	Time	Location	Observation	Odour Character & Intensity	odour intensity	Weather Conditions	Comments	Control/Corrective Action	Date Implemented	Inspected By	Public/EPA Complaint enter date /trim no
	Time of Day & Observation	List each location	Observed odour/smell, YES/NO	Describe the odor and its strength	0. No odour 1. Very Faint Odour 2.Faint Odour 3. distinct odour 4. Strong Odour 5. Very Strong Odour	Temperature (very warm, warm, mild , cold) wind strength (none, light, steady, strong, gusting) wind direction (eg from NE), humidity, rain, Sunny, cloudy etc.					
23/04/2018	8.00am-10.00am	Glengarry Cottage	Odour observed at Glengarry cottage 8.00am - 9.15am	Organic/tip smell -	4	Sunny, slight breeze. Approx 22 degress	DK and BH - parked outside soilco on Reddalills road and observed strong odour at that location. Drove to Farmborough Heights - Fairloch Ave Highview Dr and Farmborough road (west end) No odour was observed at ths location	Does not appear to be generated from waste depot	23/04/2018	Della and Brock	
14/12/2018	8.30am	Unanderra	NO	NA	NA	approx 30mm. Gentle	inspection of the	No odour detected		Wayne	
17/12/2018	2.55pm	Orana Rd,	observed.	observed	0	slight breeze, warm					
17/02/2018	3.05pm	Bristol Pde, Farmborough Heights	No odour observed. Slight breeze.	No odour observed	0	slight breeze, warm		No odour detected		Corey Stoneham	
18/12/2018	5.00pm	Farmborough Rd, Bristol and Fairloch Avenue	No offensive odour observed slight SE breeze	No odour observed	0	slight breeze, warm	Proactive patrol	No odour detected		L McKenzie	The EPA received a call via Environment Line on 18 December 2018 reporting a "terrible rubbish odour" starting today at 7:00am and still continuing at 8:05 am (Ref no. I18414-2018).

WASTE SERVICES - ODOUR INSPECTON/DIAGNOSTIC LOG - observations that may assist in tracking down the source of a smell or odor

For each observation note the status of odour factors listed in order to correlate presence or absence of an odour or smell with other conditions

Date	Time	Location	Observation	Odour Character & Intensity	odour intensity	Weather Conditions	Comments	Control/Corrective Action	Date Implemented	Inspected By	Public/EPA Complaint enter date /trim no
	Time of Day & Observation	List each location	Observed odour/smell, YES/NO	Describe the odor and its strength	0. No odour 1. Very Faint Odour 2.Faint Odour 3. distinct odour 4. Strong Odour 5. Very Strong Odour	Temperature (very warm, warm, mild , cold) wind strength (none, light, steady, strong, gusting) wind direction (eg from NE), humidity, rain, Sunny, cloudy etc.					
19/12/2018	1.45om	Stratford Road, Unanderra Farmborough Dr, Highview Drive and Fairloch Avenue Farmborough Heights	No offensive odour observed still conditions	No odour observed	0	still, overcast	Proactive patrol	No odour detected		D Kutzner	
20/12/2018	7.30am	Stratford Road, Unanderra Farmborough Dr, Highview Drive and Fairloch Avenue Farmborough Heights	No offensive odour observed still conditions	No odour observed	0	Sunny, warm	Proactive patrol	No odour detected		L McKenzie	I was in on the 28th and there was no obvious odour that I observed when driving along the eastern road. Both deodorisers were working till 4:30pm and the lids and cover material were placed as per usual. There was a strong smell coming from the green waste at SoilCo on Reddalls Rd which may have contributed to the smell.
28/12/2018		Whytes gully	No offensive odour observed still conditions	No odour observed							

WASTE SERVICES - ODOUR INSPECTON/DIAGNOSTIC LOG - observations that may assist in tracking down the source of a smell or odor

For each observation note the status of odour factors listed in order to correlate presence or absence of an odour or smell with other conditions

Date	Time	Location	Observation	Odour Character & Intensity	odour intensity	Weather Conditions	Comments	Control/Corrective Action	Date implemented	Inspected By	Public/EPA Complaint enter date /trim no
	Time of Day & Observation	List each location	Observed odour/smell, YES/NO	Describe the odor and its strength	0. No odour 1. Very Faint Odour 2.Faint Odour 3. distinct odour 4. Strong Odour 5. Very Strong Odour	Temperature (very warm, warm, mild , cold) wind strength (none, light, steady, strong, gusting) wind direction (eg from NE), humidity, rain, Sunny, cloudy etc.					
3/01/2019	10.00am	Stratford Road, Unanderra Farmborough Dr, Highview Drive and Fairloch Avenue Farmborough Heights	No offensive odour observed still conditions	No odour observed	0	Sunny, warm	Proactive patrol	No odour detected		D Kutzner	
4/01/2019		Stratford Road, Unanderra Farmborough Dr, Highview Drive and Fairloch Avenue Farmborough Heights	No offensive odour observed still conditions	No odour observed	0	Sunny, warm.	Proactive patrol	No odour detected		D Kutzner	
5/01/2019	10.00am	Stratford Road, Unanderra Farmborough Dr, Highview Drive and Fairloch Avenue Farmborough Heights	TANKER FIRE on M1 No odour observed	No odour observed	0	Temperature 30+ ths morning but dropping with the southerly winds starting to intensify	Proactive patrol	No odour detected		L McKenzie	
8/01/2019		Stratford Road, Unanderra	No offensive odour observed			Sunny, warm. Rain last night	Proactive patrol	No odour detected		D Kutzner	
11/01/2019	4.50pm	Fairloch Ave and Loch View Ave, Farmborough Heights	No offensive odour observed. Still conditions	No odour observed	0	Sunny , warm	Proactive patrol	No odour detected		C Stoneham	

WASTE SERVICES - ODOUR INSPECTON/DIAGNOSTIC LOG - observations that may assist in tracking down the source of a smell or odor

For each observation note the status of odour factors listed in order to correlate presence or absence of an odour or smell with other conditions

Date	Time	Location	Observation	Odour Character & Intensity	odour intensity	Weather Conditions	Comments	Control/Corrective Action	Date Implemented	Inspected By	Public/EPA Complaint enter date /trim no
	Time of Day & Observation	List each location	Observed odour/smell, YES/NO	Describe the odor and its strength	0. No odour 1. Very Faint Odour 2.Faint Odour 3. distinct odour 4. Strong Odour 5. Very Strong Odour	Temperature (very warm, warm, mild , cold) wind strength (none, light, steady, strong, gusting) wind direction (eg from NE), humidity, rain, Sunny, cloudy etc.					
15/01/2019	2.00pm	Stratford Road, Unanderra Farmborough Dr, Highview Drive and Fairloch Avenue Farmborough Heights	No offensive odour observed. Sunny , warn , still	No odour observed	0	Sunny, warm	Proactive patrol	No odour detected		D Kutzner	
16/01/2019	2.30pm	Fairloch Ave and High View Ave, Farmborough Heights	No offensive odour observed. Still conditions	No odour observed	0	Sunny, warm	Proactive patrol	No odour detected		D Kutzner	
17/01/2019	7.15 - 7.45am	Fairloch Ave and High View Ave, Farmborough Heights	No offensive odour observed. Still conditions	No odour observed	0	Sunny, warm	Proactive patrol	No odour detected		D Kutzner	
5/02/2019	8:30am	Fairloch Ave and High View Ave, Farmborough Heights	No offensive odour observed. Light S wind	No odour observed	0	Rainy, Cool	Proactive patrol	No odour detected		J Shoveller	
4/03/2019	1pm	Fairloch Ave and High View Ave, Farmborough Heights	No offensive odour observed. Light NE wind	No odour observed	0	warm, slight wind,	Proactive patrol	No odour detected		C Thurgar	
12/03/2019	9am	Fairloch Ave and High View Ave, Farmborough Heights	No offensive odour observed. Light N wind	No odour observed	0	warm, slight wind,	Proactive patrol	No odour detected		C Thurgar	

WASTE SERVICES - ODOUR INSPECTON/DIAGNOSTIC LOG - observations that may assist in tracking down the source of a smell or odor

For each observation note the status of odour factors listed in order to correlate presence or absence of an odour or smell with other conditions

Date	Time	Location	Observation	Odour Character & Intensity	odour intensity	Weather Conditions	Comments	Control/Corrective Action	Date Implemented	Inspected By	Public/EPA Complaint enter date /trim no
	Time of Day & Observation	List each location	Observed odour/smell, YES/NO	Describe the odor and its strength	0. No odour 1. Very Faint Odour 2.Faint Odour 3. distinct odour 4. Strong Odour 5. Very Strong Odour	Temperature (very warm, warm, mild , cold) wind strength (none, light, steady, strong, gusting) wind direction (eg from NE), humidity, rain, Sunny, cloudy etc.					
14/03/2019	8.15am	Fairloch Ave and High View Ave, Farmborough Heights	No offensive odour observed. Overcast weather. E winds light	No odour observed	0	cool, overcast	Proactive patrol	No odour detected		C Thurgar	
19/01/2019	10am	Fairfoch Ave and High View Ave, Farmborough Heights	No offensive odour observed. Overcast weather. S winds light	No odour observed	0	cool, overcast	Proactive patrol	No odour detected		C Thurgar	

Air Pollution Complaints for Whytes Gully
Between 2/03/2018 and 1/03/2019

Request Number	Request Type	Date Received	Completed Date	Actioning officer	Status
582041	Air Pollution - Residential	7/03/2018	7/03/2018	Della Kutzner	Completed
583433	Air Pollution - Residential	20/03/2018	21/03/2018	Della Kutzner	Completed
584162	Air Pollution - Residential	27/03/2018	27/03/2018	Della Kutzner	Completed
586617	Air Pollution - Residential	24/04/2018	24/04/2018	Della Kutzner	Completed
608448	Air Pollution - Commercial/Industrial	3/12/2018	18/02/2019	Della Kutzner	Completed
609640	Air Pollution - Commercial/Industrial	13/12/2018	14/12/2018	Della Kutzner	Completed
609643	Air Pollution - Commercial/Industrial	13/12/2018	14/12/2018	Della Kutzner	Completed
609647	Air Pollution - Commercial/Industrial	13/12/2018	10/01/2019	Della Kutzner	Completed
609648	Air Pollution - Commercial/Industrial	13/12/2018	14/12/2018	Della Kutzner	Completed
609652	Air Pollution - Commercial/Industrial	13/12/2018	14/12/2018	Della Kutzner	Completed
610329	Air Pollution - Commercial/Industrial	19/12/2018	10/01/2019	Della Kutzner	Completed
610429	Air Pollution - Commercial/Industrial	20/12/2018	10/01/2019	Della Kutzner	Completed
611605	Air Pollution - Commercial/Industrial	11/01/2019	14/01/2019	Della Kutzner	Completed
611606	Air Pollution - Commercial/Industrial	11/01/2019	14/01/2019	Della Kutzner	Completed
612255	Air Pollution - Commercial/Industrial	18/01/2019	24/01/2019	Della Kutzner	Completed
612256	Air Pollution - Commercial/Industrial	18/01/2019	24/01/2019	Della Kutzner	Completed
612257	Air Pollution - Commercial/Industrial	18/01/2019	24/01/2019	Della Kutzner	Completed
612258	Air Pollution - Commercial/Industrial	18/01/2019	24/01/2019	Della Kutzner	Completed
612259	Air Pollution - Commercial/Industrial	18/01/2019	24/01/2019	Della Kutzner	Completed
612260	Air Pollution - Commercial/Industrial	18/01/2019	24/01/2019	Della Kutzner	Completed
612262	Air Pollution - Commercial/Industrial	18/01/2019	24/01/2019	Della Kutzner	Completed
614223	Air Pollution - Commercial/Industrial	6/02/2019	12/04/2019	Courtney Thurgar	Completed
615779	Air Pollution - Commercial/Industrial	21/02/2019	12/04/2019	Courtney Thurgar	Completed

Number of Requests = 23

Appendix H: Fire Record

FORM ENVIRONMENTAL INCIDENT REPORT - (1)

Complete this form for all environmental incidents that occur at or on Wollongong City Council worksites.

MATERIAL HARM INCIDENTS MUST BE REPORTED TO 5 ESSENTIAL AGENCIES IMMEDIATELY

i it involves actual or potential harm to the health or safety of human beings or to ecosystems that is not trivial, or

ii it results in actual or potential loss or property damage of an amount, or amounts in aggregate, exceeding $10,000 (or such other amount as is prescribed by the regulations), and

iii loss includes the reasonable costs and expenses that would be incurred in taking all reasonable and practicable measures to prevent, mitigate or make good harm to the environment

The purpose of this form (1) is to alert Waste Service to potential environmental incidents. It does not represent Wollongong City Council's final position for any incident reported on this form.

REMEMBER

Complete all fields prior to submitting form
Be succinct, stick to the facts and do not make assumptions
Only record information you know to be correct

INCIDENT DETAILS

Date 31/7/2018	Time 3.30pm	☐ am ☑ pm	Duration <10 minutes	HPRM: PATHWAY:

DESCRIPTION: Provide a brief description of what happened during the incident (MATERIAL HARM INCIDENT – 5 ESSENTIAL AGENCIES MUST BE NOTIFIED IMMEDIATELY)	Fire on site - The loader operator pushed waste in the transfer station to the push wall and loaded the material into the hooklift bin. As the material dropped in to the bin the operator noticed a flash and flames. Friction when transferrring material to hooklift bin caused ignition of an unknown substance. The fire also spread onto the ground.
FIRE on site -See page 3 of this form for additional data collection (LEMP R4.1)	
EXACT location of the incident (include chainage, landmarks, features, nearest cross street – provide a sketch if appropriate	Wollongong Waste and Resource Recovery Park (Whytes Gully) Transfer Station
Quantity or volume of material discharged or affected by incident (provide estimate if quantity is unknown)	Approximately 2.0 cubic metres of domestic waste was ignitedl
Estimated distance to nearest waterway. This can include stormwater drains and dry watercourses (where relevant)	70 meters
Type of activity that caused incident (what works were in progress at the time of the incident?)	Loader was loading domestic waste from transfer station bay to the hook lift bin
How was the incident identified? (eg employee, Contractor, community, complaint)	Waste Operative noticed a flash and then flames when he deposited waste into the hooklift bin
Name and contact details of complainant (where relevant)	NA
Address of complainant	NA
Odour intensity	☐ 0 **No odour** ☐ 1 **Very faint odour** ☐ 2 **Faint odour** ☐ 3 **Distinct odour** ☐ 4 **Strong odour** ☐ 5 **Very strong odour**
If Odour, describe complainants description of odour. What does it smell like?	NA
Describe weather conditions at the time Temperature(very warm, warm, mild, cold) Wind Strength (none, light, steady, strong, gusting) Wind Direction (eg from NE)	Sunny - WNW winds 22km/h
Describe weather conditions during recent weeks Temperature(very warm, warm, mild, cold) Wind Strength (none, light, steady, strong, gusting) Wind Direction (eg from NE)	Dry , sunny, relatlively warm
Any other details of the incident (including any information which did not fit in spaces above, as well as any special circumstances of the day or the location)	NA
What immediate actions/control measures were taken to rectify or contain the incident?	Waste Operative in the loader smothered the flames with 3 bucket-loads of soil. A water cart that was on site came to assist shortly therefafter spraying water into the hooklift bin.
What corrective action has been taken to prevent similar incidents recurring?	Debrief of incident with staff occurred at weighbridge at 4.50pm. Liquid waste is a prohibited waste on site and signage to this effect is at the entry to site. Staff are trained accordingly that this type of waste is not accepted over the weighbridge. Inspection of loads will continue and signage will remain in place.

ENVIRONMENTAL INCIDENT REPORT - (1)

FORM

Waste Operatives to be vigilant and monitor site for compliance.

INCIDENT CATEGORY

Potential Category 1: Incident (may involve one or more of the following (tick incident type)

- ☐ Material, odour or noise that travels beyond site boundary causing or potentially causing adverse impact to the environment or community
- ☐ Discharge of waters from site not in accordance with any applicable REF determination/approval/environment protection licence condition□
- ☐ A fire that travels beyond site boundary
- ☐ Unauthorised harm or desecration to Aboriginal objects and Aboriginal places
- ☐ Failure to comply with a REF determination / approval / environment protection licence condition.
- ☐ Unauthorised harm or damage to threatened species, endangered populations, endangered ecological communities or critical habitat.
- ☐ Unauthorised harm or damage to threatened aquatic species and protected marine vegetation or unauthorised dredging of reclamation works within a watercourse.
- ☐ Unauthorised damage or destruction to any State or locally significant relic or Heritage item
- ☐ Material harm to the environment or persons as per Part 5.7 of POEO Act (including harm on site)
- ☐ Works undertaken without required approval or environmental assessment.

Potential Category 2: Incident (may involve one or more of the following (tick incident type)

- ☐ Failure to implement component of Environment Management Plan that does not result in a Category 1 incident
- ☐ Spills that do not leave the site boundary and are cleaned up without material environmental harm or residual environmental impact.
- ☑ A fire contained on site without causing impact to the environment

SIGN-OFF (Person Making Report)

Print Name	Della Kutzner	Position	WHS, Quality and Environmental Officer
Signature		Date	1/8/2018

NOTIFICATION TO THE 5 ESSENTIAL AGENCIES (Where material harm identified notify immediately)

To be completed by the relevant Manager or delegated authority. Were relevant authorities notified under part 5.7 of POEO Act?

Authority	Number			Date and Time Notified
Fire and Rescue	000	☑ Yes	☐ No	31/7/2018 3.35pm
Wollongong City Council	4227 7111	☑ Yes	☐ No	
EPA NSW	131 555	☑ Yes	☐ No	3.50pm
The Ministry of Health	4222 5000	☐ Yes	☑ No	
SafeWork NSW	13 10 50	☐ Yes	☑ No	
Fire and Rescue	1300 729 579	☐ Yes	☐ No	NA
Department of Planning	4224 9450	☐ Yes	☑ No	
Surrounding Land Holders (if necessary)	Refer to Pollution Incident Response Management Plan (PIRMP) for contacts	☐ Yes	☑ No	

Who notified the EPA?

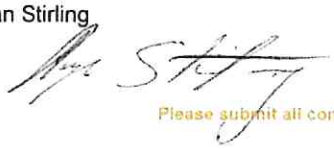
Name Ryan Stirling Position Waste Services Manager (Acting)

Notification Method ☑ Phone ☐ Onsite Date 31/7/2018 Time 3.50pm ☐ am ☑ pm

Has there been an EPA Environmental Line Complaint? ☑ Yes ☐ No EPA Complaint Nº C10575-2018

Authorities notified and why: (eg Essential Agencies and Neighbouring properties) None

Sign off (Manager / delegated authority officer)

Print Name	Ryan Stirling	Position	Waste Services Manager (Acting)
Signature		Date	2/8/2018

Please submit all completed forms to relevant Area Manager

OTHER REPORTING CONDITIONS

R4.1 The licensee must maintain a daily log and record the following data of fires at the site:

a)	Time and date when the fire was deliberately started or reported	Fire started at the Transfer Station at 3.30pm, 31 July 2018. The Waste Operative in the immediate vicinity alerted the Waste Coordinator immediately, who in turn alerted the Waste Services Manager. The Waste Services Manager immediately called 000 and reported the fire to Fire & Rescue. A short time later the Waste Services Manager (Acting) reported the incident to the EPA Hotline (~3.50pm).
b)	Whether the fire was authorised by the licensee, and, if not, the circumstances which ignited the fire	The fire was not authorised. A flammable liquid was dropped off by a customer within a load of waste. The loader operator pushed a bulk pile of waste on the ground in the Transfer Station to the push wall and loaded the material into a hooklift bin. As the material dropped into the bin the operator noticed a flash and flames. It is likely that friction between loader bucket and the ground caused a spark that ignited the flammable liquid, which in turn began to burn the surrounding waste. Once inside the hooklift bin the fire spread to other waste within it, but it was completely contained within the bin.
c)	The time and date that the fire ceased and whether it burnt out or was extinguished	The fire was extinguished at 3.40pm, 31 July 2018
d)	The location of the fire (eg clean timber stockpile, putrescible garbage cell etc)	Transfer Station - domestic putrescible waste drop-off zone
e)	Prevailing weather conditions	Sunny WNW 22 km/hour winds
f)	Observations made in regard to smoke direction and dispersion	Smoke was blown towards the east. It was observed to disperse quite readily. The smoke was not visible/completely dispersed in the air well within the boundary of the site.
g)	The amount of waste that was combusted by the fire	Approximately 2 m3
h)	Action taken to extinguish the fire	Using a front end loader the Waste Operative smothered the fire with 3 bucket loads of soil. Contractors on site (Ertech) came to the incident with their water truck and completed smothering the fire. RFS checked with infrared; no heat detected and gave the all clear to continue operations at 4.15pm

Appendix I: Community Consultation

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WHYTES GULLY REFERENCE GROUP

NOTES OF MEETING HELD ON 23 May 2018 AT GLENGARRY COTTAGE - 5.45 PM

PRESENT:

J Coulton (Chair)	Wollongong City Council
G Siroky (Minutes)	Wollongong City Council
B Wooton	**Community Representative**

APOLOGIES:

C Emery	Soilco
C Wade	Remondis
J Waples	Community Representative
L & R Truninger	Community Representative

No formal meeting was held as there was only one attendee.

A general discussion ensued between Mr Barry Wooton and Mr Joel Coulton. Some items raised: -

Barry Wooton advised that he reports odour to the EPA hotline and noted that there was odour on and around 6 March and 5 April 2018.

Joel Coulton advised that the deodoriser trailer with a neutral scent is used and that a tarp cover is currently being investigation to better contain odour.

Joel Coulton gave Mr Wooton a presentation showing progress and updates on the landfill site and other waste related information.

Mr Wooton also mentioned a sub-development/subdivision being proposed for a site opposite Van Da Haar's property and that the prospective owners will be informed that they are purchasing land close to a tip.

It is proposed that the next meeting will be scheduled for some time in November 2018.

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WHYTES GULLY REFERENCE GROUP

Note of Meeting Held 13 February 2019
At Glengarry Cottage - 5.30 PM

PRESENT:

Corey Stoneham – Manager Waste and Resource Recovery (*Wollongong City Council*)
Luke McKenzie – Landfill Manager (*Wollongong City Council*)
Charlie Emery (*Soilco*)
Chris Wade (*Remondis*)
Barry Wooton (*Community Representative*)
Ziggy Osiadacz (*Community Representative*)
Alison Honner (*Community Representative*)
Craig Honner (*Community Representative*)
Mark Smith (*Community Representative*)
Tony Atkins (*Community Representative*)
John Lucas (*Community Representative*)

APOLOGIES:

Jan Waples (*Community Representative*)

Welcome:

- Manager Waste and Compliance (Corey Stoneham) welcomed everyone to the meeting and introduced Council staff and contractors.

Current Projects:

- New landfill cell discussed. Cell has a life expectancy of approximately 6 years. Planning for next cell is underway.
- A FOGO (Food Organics Garden Organics) collections and processing trial is planned for 2019. This program is similar to that in place in Shellharbour and Kiama Councils and aims to divert food waste from landfill.
- Procurement is underway for a more extensive landfill gas capture project at Whytes Gully. This will see additional methane gas captured and used for energy generation. This is seen as a significant environmental win at the site.
- Some minor upgrade works will be undertaken to renew part of the current leachate treatment plant.
- There was some discussion around the recent media outlining an alternative waste technology plant to be constructed at Nowra.

Operational Issues;

- Odour management at the site was discussed. It was raised that odour had been an issue on a number of days in January. Council outlined the odour management practices currently in place as well as a number proposed improvements. Current odour management practices include;
    - Two deodoriser trailers in operation
    - Use of cover material each day and at the end of operations in conjunction with the use of large metal landfill lids
    - Proactive weekly inspections in the Farmborough Heights and Unanderra area
    - Cessation of waste being placed in the top landfill cell as of late January 2019.

- Vehicle parking was discussed prior to gates opening at 7.30am. A number of residents raised concerns with this and cited traffic safety issues. This was noted as an issue at both Whytes Gully and the Soilco site. A number of recent actions were noted included installation of No Parking signs after tabling of the issue in late 2018 at a Council Traffic Committee Meeting.

Action:
Council is to write to commercial customers to remind of site opening hours and parking requirements.

General Business
- The ongoing issue of plastic bags and windblown litter was discussed. – particularly along boundary fences adjoining neighbouring properties. Council acknowledged that this was a challenge onsite and a number of initiatives were underway to improve this.
- Council spoke about revegetation works currently underway across the site including weed removal at the northern end of the site and tree planting along the Reddalls Rd boundary.

Meeting closed at 6.30pm

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Appendix J: Annual Return (2018-2019)

Annual Return

WOLLONGONG CITY COUNCIL

Licence 5862

A. Statement of Compliance - Licence Details

ALL Licence holders must check that the Licence details in Section A are correct.

If there are changes to any of these details, **you must advise Environment Protection Authority (EPA) and apply as soon as possible for a variation to your Licence or for a Licence transfer.**

Licence variation and transfer application forms are available on the EPA website at: http://www.epa.nsw.gov.au/licensing-and-regulation/licensing or from regional offices of the EPA, or by contacting by telephone 02 9995 5700.

If you are applying to vary or transfer your Licence, you must still complete and submit this Annual Return.

A1. Licence holder

Licence number	: 5862
Licence holder	: WOLLONGONG CITY COUNCIL
Trading name *(if applicable)*	:
ABN	: 63 139 525 939
ACN	:
Reporting period	: From: 29-5-2018 To: 28-5-2019

A2. Premises to which Licence Applies (if applicable)

Common name (if any)	: WHYTES GULLY WASTE DISPOSAL FACILITY
Premises	: REDDALLS ROAD KEMBLA GRANGE 2526 NSW

A3. Activities to which Licence Applies

Waste disposal (application to land)

A4. Other Activities (if applicable)

A5. Fee-Based Activity Classifications

Note that the fee based activity classification is used to calculate the administrative fee.

Fee-based activity	Activity scale	Unit of measure
Waste disposal by application to land	> 0.00	capacity

A6. Assessable Pollutants (if applicable)

Note that the identification of assessable pollutants is used to calculate the **load-based fee.**
The following assessable pollutants are identified for the fee-based activity classifications in the licence:

B. Monitoring and Complaints Summary

B1. Number of Pollution Complaints

Pollution Complaint Category	Complaints
Air	23
Water	0
Noise	0
Waste	0
Other	0
Total complaints recorded by the licensee during the reporting period	**23**

B2. Concentration Monitoring Summary

For each concentration monitoring point identified in your licence, details are displayed below. If concentration monitoring is not required by your licence, **no data** will appear below.
If data was provided from an uploaded file, the file name will be displayed below instead of any data.
Note that this does not exclude the need to conduct appropriate concentration monitoring of assessable pollutants as required by load-based licensing (if applicable).

Discharge & Monitoring Point 1

Stormwater monitoring and discharge point, Outlet at Reddalls Road - Monitoring point labelled 1 on Figure 13 titled "Proposed Surface Water Monitoring Locations" dated 26 March 2012 (Whytes Gully New Landfill Cell EA - Volume IV). E297777 N6183972

Pollutant	Unit of measure	No. of samples required	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Alkalinity (as calcium carbonate)	milligrams per litre					
Ammonia	milligrams per litre					
Calcium	milligrams per litre					
Chloride	milligrams per litre					
Conductivity	microsiemens per centimetre					
Dissolved Oxygen	milligrams per litre					

Filterable iron	milligrams per litre					
Fluoride	milligrams per litre					
Magnesium	milligrams per litre					
Nitrate	milligrams per litre					
pH	pH					
Potassium	milligrams per litre					
Sodium	milligrams per litre					
Sulfate	milligrams per litre					
Temperature	degrees Celsius					
Total organic carbon	milligrams per litre					
Total Phenolics	milligrams per litre					
Total suspended solids	milligrams per litre					

Monitoring Point 3

Surface gas monitoring, Areas where intermediate or final cover has been placed.

Pollutant	Unit of measure	No. of samples required	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Methane	percent by volume					

Monitoring Point 4

Gas accumulation monitoring, Inside all buildings within 250 metres of deposited waste.

Pollutant	Unit of measure	No. of samples required	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Methane	percent by volume					

Monitoring Point 5

Groundwater quality monitoring , Monitoring point labelled GABH02 on Figure 15 titled "Current Site Investigation Locations" dated 6 March 2012 (Whytes Gully New Landfill Cell EA - Volume IV). E297754.9 N6184377

Pollutant	Unit of measure	No. of samples required	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Alkalinity (as calcium carbonate)	milligrams per litre					
Aluminium	milligrams per litre					
Arsenic	milligrams per litre					
Barium	milligrams per litre					
Benzene	milligrams per litre					
Cadmium	milligrams per litre					
Calcium	milligrams per litre					
Chloride	milligrams per litre					
Chromium (hexavalent)	milligrams per litre					
Chromium (total)	milligrams per litre					
Cobalt	milligrams per litre					
Conductivity	microsiemens per centimetre					
Copper	milligrams per litre					
Ethyl benzene	micrograms per litre					
Fluoride	milligrams per litre					
Lead	milligrams per litre					
Magnesium	milligrams per litre					
Manganese	micrograms per litre					
Mercury	milligrams per litre					
Nitrate	milligrams per litre					
Nitrite	milligrams per litre					

Nitrogen (ammonia)	milligrams per litre					
Organochlorine pesticides	milligrams per litre					
Organophosphate pesticides	milligrams per litre					
pH	pH					
Polycyclic aromatic hydrocarbons	milligrams per litre					
Potassium	milligrams per litre					
Sodium	milligrams per litre					
Standing Water Level	metres					
Sulfate	milligrams per litre					
Toluene	milligrams per litre					
Total dissolved solids	milligrams per litre					
Total organic carbon	milligrams per litre					
Total petroleum hydrocarbons	milligrams per litre					
Total Phenolics	milligrams per litre					
Xylene	milligrams per litre					
Zinc	milligrams per kilogram					

Monitoring Point 9

Groundwater quality monitoring, Monitoring point labelled GMW102 on Figure 15 titled "Current Site Investigation Locations" dated 6 March 2012 (Whytes Gully New Landfill Cell EA - Volume IV). E297952.6 N6184807

Pollutant	Unit of measure	No. of samples required	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Alkalinity (as calcium carbonate)	milligrams per litre					
Aluminium	milligrams per litre					
Arsenic	milligrams per litre					
Barium	milligrams per litre					

Benzene	milligrams per litre					
Cadmium	milligrams per litre					
Calcium	milligrams per litre					
Chloride	milligrams per litre					
Chromium (hexavalent)	milligrams per litre					
Chromium (total)	milligrams per litre					
Cobalt	milligrams per litre					
Conductivity	microsiemens per centimetre					
Copper	milligrams per litre					
Ethyl benzene	micrograms per litre					
Fluoride	milligrams per litre					
Lead	milligrams per litre					
Magnesium	milligrams per litre					
Manganese	micrograms per litre					
Mercury	milligrams per litre					
Nitrate	milligrams per litre					
Nitrite	milligrams per litre					
Nitrogen (ammonia)	milligrams per litre					
Organochlorine pesticides	milligrams per litre					
Organophosphate pesticides	milligrams per litre					
pH	pH					
Polycyclic aromatic hydrocarbons	milligrams per litre					
Potassium	milligrams per litre					
Sodium	milligrams per litre					
Standing Water Level	metres					

Sulfate	milligrams per litre					
Toluene	milligrams per litre					
Total dissolved solids	milligrams per litre					
Total organic carbon	milligrams per litre					
Total petroleum hydrocarbons	milligrams per litre					
Total Phenolics	milligrams per litre					
Xylene	milligrams per litre					
Zinc	milligrams per kilogram					

Monitoring Point 10

Groundwater quality monitoring, Monitoring point labelled GMW103 on Figure 15 titled "Current Site Investigation Locations" dated 6 March 2012 (Whytes Gully New Landfill Cell EA - Volume IV). E298470.2 N6184603

Pollutant	Unit of measure	No. of samples required	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Alkalinity (as calcium carbonate)	milligrams per litre					
Aluminium	milligrams per litre					
Arsenic	milligrams per litre					
Barium	milligrams per litre					
Benzene	milligrams per litre					
Cadmium	milligrams per litre					
Calcium	milligrams per litre					
Chloride	milligrams per litre					
Chromium (hexavalent)	milligrams per litre					
Chromium (total)	milligrams per litre					
Cobalt	milligrams per litre					

Conductivity	microsiemens per centimetre					
Copper	milligrams per litre					
Ethyl benzene	micrograms per litre					
Fluoride	milligrams per litre					
Lead	milligrams per litre					
Magnesium	milligrams per litre					
Manganese	micrograms per litre					
Mercury	milligrams per litre					
Nitrate	milligrams per litre					
Nitrite	milligrams per litre					
Nitrogen (ammonia)	milligrams per litre					
Organochlorine pesticides	milligrams per litre					
Organophosphate pesticides	milligrams per litre					
pH	pH					
Polycyclic aromatic hydrocarbons	milligrams per litre					
Potassium	milligrams per litre					
Sodium	milligrams per litre					
Standing Water Level	metres					
Sulfate	milligrams per litre					
Toluene	milligrams per litre					
Total dissolved solids	milligrams per litre					
Total organic carbon	milligrams per litre					
Total petroleum hydrocarbons	milligrams per litre					
Total Phenolics	milligrams per litre					
Xylene	milligrams per litre					

Zinc	milligrams per kilogram					

Monitoring Point 11

Groundwater quality monitoring, Monitoring point labelled GMW104 on Figure 15 titled "Current Site Investigation Locations" dated 6 March 2012 (Whytes Gully New Landfill Cell EA - Volume IV). E297597.9 N6184508

Pollutant	Unit of measure	No. of samples required	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Alkalinity (as calcium carbonate)	milligrams per litre					
Aluminium	milligrams per litre					
Arsenic	milligrams per litre					
Barium	milligrams per litre					
Benzene	milligrams per litre					
Cadmium	milligrams per litre					
Calcium	milligrams per litre					
Chloride	milligrams per litre					
Chromium (hexavalent)	milligrams per litre					
Chromium (total)	milligrams per litre					
Cobalt	milligrams per litre					
Conductivity	microsiemens per centimetre					
Copper	milligrams per litre					
Ethyl benzene	micrograms per litre					
Fluoride	milligrams per litre					
Lead	milligrams per litre					
Magnesium	milligrams per litre					
Manganese	micrograms per litre					

Mercury	milligrams per litre					
Nitrate	milligrams per litre					
Nitrite	milligrams per litre					
Nitrogen (ammonia)	milligrams per litre					
Organochlorine pesticides	milligrams per litre					
Organophosphate pesticides	milligrams per litre					
pH	pH					
Polycyclic aromatic hydrocarbons	milligrams per litre					
Potassium	milligrams per litre					
Sodium	milligrams per litre					
Standing Water Level	metres					
Sulfate	milligrams per litre					
Toluene	milligrams per litre					
Total dissolved solids	milligrams per litre					
Total organic carbon	milligrams per litre					
Total petroleum hydrocarbons	milligrams per litre					
Total Phenolics	milligrams per litre					
Xylene	milligrams per litre					
Zinc	milligrams per kilogram					

Monitoring Point 12

Groundwater quality monitoring, Monitoring point labelled GMW105 on Figure 15 titled "Current Site Investigation Locations" dated 6 March 2012 (Whytes Gully New Landfill Cell EA - Volume IV). E298433.3 N6184397

Pollutant	Unit of measure	No. of samples required	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Alkalinity (as calcium carbonate)	milligrams per litre					

Aluminium	milligrams per litre					
Arsenic	milligrams per litre					
Barium	milligrams per litre					
Benzene	milligrams per litre					
Cadmium	milligrams per litre					
Calcium	milligrams per litre					
Chloride	milligrams per litre					
Chromium (hexavalent)	milligrams per litre					
Chromium (total)	milligrams per litre					
Cobalt	milligrams per litre					
Conductivity	microsiemens per centimetre					
Copper	milligrams per litre					
Ethyl benzene	micrograms per litre					
Fluoride	milligrams per litre					
Lead	milligrams per litre					
Magnesium	milligrams per litre					
Manganese	micrograms per litre					
Mercury	milligrams per litre					
Nitrate	milligrams per litre					
Nitrite	milligrams per litre					
Nitrogen (ammonia)	milligrams per litre					
Organochlorine pesticides	milligrams per litre					
Organophosphate pesticides	milligrams per litre					
pH	pH					
Polycyclic aromatic hydrocarbons	milligrams per litre					

Potassium	milligrams per litre					
Sodium	milligrams per litre					
Standing Water Level	metres					
Sulfate	milligrams per litre					
Toluene	milligrams per litre					
Total dissolved solids	milligrams per litre					
Total organic carbon	milligrams per litre					
Total petroleum hydrocarbons	milligrams per litre					
Total Phenolics	milligrams per litre					
Xylene	milligrams per litre					
Zinc	milligrams per kilogram					

Monitoring Point 13

Groundwater quality monitoring, Monitoring point labelled GMW106 on Figure 15 titled "Current Site Investigation Locations" dated 6 March 2012 (Whytes Gully New Landfill Cell EA - Volume IV). E298356.8 N6184294

Pollutant	Unit of measure	No. of samples required	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Alkalinity (as calcium carbonate)	milligrams per litre					
Aluminium	milligrams per litre					
Arsenic	milligrams per litre					
Barium	milligrams per litre					
Benzene	milligrams per litre					
Cadmium	milligrams per litre					
Calcium	milligrams per litre					
Chloride	milligrams per litre					

Chromium (hexavalent)	milligrams per litre					
Chromium (total)	milligrams per litre					
Cobalt	milligrams per litre					
Conductivity	microsiemens per centimetre					
Copper	milligrams per litre					
Ethyl benzene	micrograms per litre					
Fluoride	milligrams per litre					
Lead	milligrams per litre					
Magnesium	milligrams per litre					
Manganese	micrograms per litre					
Mercury	milligrams per litre					
Nitrate	milligrams per litre					
Nitrite	milligrams per litre					
Nitrogen (ammonia)	milligrams per litre					
Organochlorine pesticides	milligrams per litre					
Organophosphate pesticides	milligrams per litre					
pH	pH					
Polycyclic aromatic hydrocarbons	milligrams per litre					
Potassium	milligrams per litre					
Sodium	milligrams per litre					
Standing Water Level	metres					
Sulfate	milligrams per litre					
Toluene	milligrams per litre					
Total dissolved solids	milligrams per litre					
Total organic carbon	milligrams per litre					

Total petroleum hydrocarbons	milligrams per litre					
Total Phenolics	milligrams per litre					
Xylene	milligrams per litre					
Zinc	milligrams per kilogram					

Monitoring Point 14

Groundwater quality monitoring, Monitoring point labelled GMW108S on Figure 15 titled "Current Site Investigation Locations" dated 6 March 2012 (Whytes Gully New Landfill Cell EA - Volume IV). E297870.2 N6184262

Pollutant	Unit of measure	No. of samples required	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Alkalinity (as calcium carbonate)	milligrams per litre					
Aluminium	milligrams per litre					
Arsenic	milligrams per litre					
Barium	milligrams per litre					
Benzene	milligrams per litre					
Cadmium	milligrams per litre					
Calcium	milligrams per litre					
Chloride	milligrams per litre					
Chromium (hexavalent)	milligrams per litre					
Chromium (total)	milligrams per litre					
Cobalt	milligrams per litre					
Conductivity	microsiemens per centimetre					
Copper	milligrams per litre					
Ethyl benzene	micrograms per litre					
Fluoride	milligrams per litre					

Lead	milligrams per litre					
Magnesium	milligrams per litre					
Manganese	micrograms per litre					
Mercury	milligrams per litre					
Nitrate	milligrams per litre					
Nitrite	milligrams per litre					
Nitrogen (ammonia)	milligrams per litre					
Organochlorine pesticides	milligrams per litre					
Organophosphate pesticides	milligrams per litre					
pH	pH					
Polycyclic aromatic hydrocarbons	milligrams per litre					
Potassium	milligrams per litre					
Sodium	milligrams per litre					
Standing Water Level	metres					
Sulfate	milligrams per litre					
Toluene	milligrams per litre					
Total dissolved solids	milligrams per litre					
Total organic carbon	milligrams per litre					
Total petroleum hydrocarbons	milligrams per litre					
Total Phenolics	milligrams per litre					
Xylene	milligrams per litre					
Zinc	milligrams per kilogram					

Monitoring Point 15

Groundwater quality monitoring, Monitoring point labelled GMW108D on Figure 15 titled "Current Site Investigation Locations" dated 6 March 2012 (Whytes Gully New Landfill Cell EA - Volume IV). E297871.4 N6184262

Pollutant	Unit of measure	No. of samples required	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Alkalinity (as calcium carbonate)	milligrams per litre					
Aluminium	milligrams per litre					
Arsenic	milligrams per litre					
Barium	milligrams per litre					
Benzene	milligrams per litre					
Cadmium	milligrams per litre					
Calcium	milligrams per litre					
Chloride	milligrams per litre					
Chromium (hexavalent)	milligrams per litre					
Chromium (total)	milligrams per litre					
Cobalt	milligrams per litre					
Conductivity	microsiemens per centimetre					
Copper	milligrams per litre					
Ethyl benzene	micrograms per litre					
Fluoride	milligrams per litre					
Lead	milligrams per litre					
Magnesium	milligrams per litre					
Manganese	micrograms per litre					
Mercury	milligrams per litre					
Nitrate	milligrams per litre					
Nitrite	milligrams per litre					
Nitrogen (ammonia)	milligrams per litre					

Organochlorine pesticides	milligrams per litre					
Organophosphate pesticides	milligrams per litre					
pH	pH					
Polycyclic aromatic hydrocarbons	milligrams per litre					
Potassium	milligrams per litre					
Sodium	milligrams per litre					
Standing Water Level	metres					
Sulfate	milligrams per litre					
Toluene	milligrams per litre					
Total dissolved solids	milligrams per litre					
Total organic carbon	milligrams per litre					
Total petroleum hydrocarbons	milligrams per litre					
Total Phenolics	milligrams per litre					
Xylene	milligrams per litre					
Zinc	milligrams per kilogram					

Monitoring Point 16

Groundwater quality monitoring, Monitoring point labelled GMW109S on Figure 15 titled "Current Site Investigation Locations" dated 6 March 2012 (Whytes Gully New Landfill Cell EA - Volume IV). E297605.7 N6184068

Pollutant	Unit of measure	No. of samples required	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Alkalinity (as calcium carbonate)	milligrams per litre					
Aluminium	milligrams per litre					
Arsenic	milligrams per litre					
Barium	milligrams per litre					
Benzene	milligrams per litre					

Cadmium	milligrams per litre					
Calcium	milligrams per litre					
Chloride	milligrams per litre					
Chromium (hexavalent)	milligrams per litre					
Chromium (total)	milligrams per litre					
Cobalt	milligrams per litre					
Conductivity	microsiemens per centimetre					
Copper	milligrams per litre					
Ethyl benzene	micrograms per litre					
Fluoride	milligrams per litre					
Lead	milligrams per litre					
Magnesium	milligrams per litre					
Manganese	micrograms per litre					
Mercury	milligrams per litre					
Nitrate	milligrams per litre					
Nitrite	milligrams per litre					
Nitrogen (ammonia)	milligrams per litre					
Organochlorine pesticides	milligrams per litre					
Organophosphate pesticides	milligrams per litre					
pH	pH					
Polycyclic aromatic hydrocarbons	milligrams per litre					
Potassium	milligrams per litre					
Sodium	milligrams per litre					
Standing Water Level	metres					
Sulfate	milligrams per litre					

Toluene	milligrams per litre					
Total dissolved solids	milligrams per litre					
Total organic carbon	milligrams per litre					
Total petroleum hydrocarbons	milligrams per litre					
Total Phenolics	milligrams per litre					
Xylene	milligrams per litre					
Zinc	milligrams per kilogram					

Monitoring Point 17

Groundwater quality monitoring, Monitoring point labelled GMW110 on Figure 15 titled "Current Site Investigation Locations" dated 6 March 2012 (Whytes Gully New Landfill Cell EA - Volume IV). E297572.6 N6184266

Pollutant	Unit of measure	No. of samples required	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Alkalinity (as calcium carbonate)	milligrams per litre					
Aluminium	milligrams per litre					
Arsenic	milligrams per litre					
Barium	milligrams per litre					
Benzene	milligrams per litre					
Cadmium	milligrams per litre					
Calcium	milligrams per litre					
Chloride	milligrams per litre					
Chromium (hexavalent)	milligrams per litre					
Chromium (total)	milligrams per litre					
Cobalt	milligrams per litre					
Conductivity	microsiemens per centimetre					

Copper	milligrams per litre					
Ethyl benzene	micrograms per litre					
Fluoride	milligrams per litre					
Lead	milligrams per litre					
Magnesium	milligrams per litre					
Manganese	micrograms per litre					
Mercury	milligrams per litre					
Nitrate	milligrams per litre					
Nitrite	milligrams per litre					
Nitrogen (ammonia)	milligrams per litre					
Organochlorine pesticides	milligrams per litre					
Organophosphate pesticides	milligrams per litre					
pH	pH					
Polycyclic aromatic hydrocarbons	milligrams per litre					
Potassium	milligrams per litre					
Sodium	milligrams per litre					
Standing Water Level	metres					
Sulfate	milligrams per litre					
Toluene	milligrams per litre					
Total dissolved solids	milligrams per litre					
Total organic carbon	milligrams per litre					
Total petroleum hydrocarbons	milligrams per litre					
Total Phenolics	milligrams per litre					
Xylene	milligrams per litre					
Zinc	milligrams per kilogram					

Monitoring Point 18

Groundwater quality monitoring, Monitoring point labelled GMW111 on Figure 15 titled "Current Site Investigation Locations" dated 6 March 2012 (Whytes Gully New Landfill Cell EA - Volume IV). E297588.6 N6184385

Pollutant	Unit of measure	No. of samples required	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Alkalinity (as calcium carbonate)	milligrams per litre					
Aluminium	milligrams per litre					
Arsenic	milligrams per litre					
Barium	milligrams per litre					
Benzene	milligrams per litre					
Cadmium	milligrams per litre					
Calcium	milligrams per litre					
Chloride	milligrams per litre					
Chromium (hexavalent)	milligrams per litre					
Chromium (total)	milligrams per litre					
Cobalt	milligrams per litre					
Conductivity	microsiemens per centimetre					
Copper	milligrams per litre					
Ethyl benzene	micrograms per litre					
Fluoride	milligrams per litre					
Lead	milligrams per litre					
Magnesium	milligrams per litre					
Manganese	micrograms per litre					
Mercury	milligrams per litre					

Nitrate	milligrams per litre					
Nitrite	milligrams per litre					
Nitrogen (ammonia)	milligrams per litre					
Organochlorine pesticides	milligrams per litre					
Organophosphate pesticides	milligrams per litre					
pH	pH					
Polycyclic aromatic hydrocarbons	milligrams per litre					
Potassium	milligrams per litre					
Sodium	milligrams per litre					
Standing Water Level	metres					
Sulfate	milligrams per litre					
Toluene	milligrams per litre					
Total dissolved solids	milligrams per litre					
Total organic carbon	milligrams per litre					
Total petroleum hydrocarbons	milligrams per litre					
Total Phenolics	milligrams per litre					
Xylene	milligrams per litre					
Zinc	milligrams per kilogram					

Monitoring Point 19

Groundwater quality monitoring, Monitoring point labelled GMW109D on Figure 15 titled "Current Site Investigation Locations" dated 6 March 2012 (Whytes Gully New Landfill Cell EA - Volume IV). E297604.9 N6184068

Pollutant	Unit of measure	No. of samples required	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Alkalinity (as calcium carbonate)	milligrams per litre					
Aluminium	milligrams per litre					

Arsenic	milligrams per litre					
Barium	milligrams per litre					
Benzene	milligrams per litre					
Cadmium	milligrams per litre					
Calcium	milligrams per litre					
Chloride	milligrams per litre					
Chromium (hexavalent)	milligrams per litre					
Chromium (total)	milligrams per litre					
Cobalt	milligrams per litre					
Conductivity	microsiemens per centimetre					
Copper	milligrams per litre					
Ethyl benzene	micrograms per litre					
Fluoride	milligrams per litre					
Lead	milligrams per litre					
Magnesium	milligrams per litre					
Manganese	micrograms per litre					
Mercury	milligrams per litre					
Nitrate	milligrams per litre					
Nitrite	milligrams per litre					
Nitrogen (ammonia)	milligrams per litre					
Organochlorine pesticides	milligrams per litre					
Organophosphate pesticides	milligrams per litre					
pH	pH					
Polycyclic aromatic hydrocarbons	milligrams per litre					
Potassium	milligrams per litre					

Sodium	milligrams per litre					
Standing Water Level	metres					
Sulfate	milligrams per litre					
Toluene	milligrams per litre					
Total dissolved solids	milligrams per litre					
Total organic carbon	milligrams per litre					
Total petroleum hydrocarbons	milligrams per litre					
Total Phenolics	milligrams per litre					
Xylene	milligrams per litre					
Zinc	milligrams per kilogram					

Monitoring Point 20

Groundwater quality monitoring, Monitoring point labelled BH6 on Figure 15 titled "Current Site Investigation Locations" dated 6 March 2012 (Whytes Gully New Landfill Cell EA - Volume IV). E297807.4 N6184052

Pollutant	Unit of measure	No. of samples required	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Alkalinity (as calcium carbonate)	milligrams per litre					
Aluminium	milligrams per litre					
Arsenic	milligrams per litre					
Barium	milligrams per litre					
Benzene	milligrams per litre					
Cadmium	milligrams per litre					
Calcium	milligrams per litre					
Chloride	milligrams per litre					
Chromium (hexavalent)	milligrams per litre					

Chromium (total)	milligrams per litre					
Cobalt	milligrams per litre					
Conductivity	microsiemens per centimetre					
Copper	milligrams per litre					
Ethyl benzene	micrograms per litre					
Fluoride	milligrams per litre					
Lead	milligrams per litre					
Magnesium	milligrams per litre					
Manganese	micrograms per litre					
Mercury	milligrams per litre					
Nitrate	milligrams per litre					
Nitrite	milligrams per litre					
Nitrogen (ammonia)	milligrams per litre					
Organochlorine pesticides	milligrams per litre					
Organophosphate pesticides	milligrams per litre					
pH	pH					
Polycyclic aromatic hydrocarbons	milligrams per litre					
Potassium	milligrams per litre					
Sodium	milligrams per litre					
Standing Water Level	metres					
Sulfate	milligrams per litre					
Toluene	milligrams per litre					
Total dissolved solids	milligrams per litre					
Total organic carbon	milligrams per litre					
Total petroleum hydrocarbons	milligrams per litre					

Total Phenolics	milligrams per litre					
Xylene	milligrams per litre					
Zinc	milligrams per kilogram					

Monitoring Point 21

Subsurface gas monitoring, Monitoring point labelled LFG MW1 on Figure 14 titled "Proposed Landfill Gas Monitoring Locations" dated 6 March 2012 (Whytes Gully New Landfill Cell EA - Volume IV). E298084 N6184278

Pollutant	Unit of measure	No. of samples required	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Methane	percent by volume					

Monitoring Point 22

Subsurface gas monitoring, Monitoring point labelled LFG MW2 on Figure 14 titled "Proposed Landfill Gas Monitoring Locations" dated 6 March 2012 (Whytes Gully New Landfill Cell EA - Volume IV). E298202 N6184228

Pollutant	Unit of measure	No. of samples required	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Methane	percent by volume					

Monitoring Point 23

Subsurface gas monitoring, Monitoring point labelled LFG MW3 on Figure 14 titled "Proposed Landfill Gas Monitoring Locations" dated 6 March 2012 (Whytes Gully New Landfill Cell EA - Volume IV). E298297 N6184244

Pollutant	Unit of measure	No. of samples required	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Methane	percent by volume					

Monitoring Point 24

Subsurface gas monitoring, Monitoring point labelled LFG MW4 on Figure 14 titled "Proposed Landfill Gas Monitoring Locations" dated 6 March 2012 (Whytes Gully New Landfill Cell EA - Volume IV). E298376 N6184303

Pollutant	Unit of measure	No. of samples required	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Methane	percent by volume					

Monitoring Point 25

Subsurface gas monitoring, Monitoring point labelled LFG MW5 on Figure 14 titled "Proposed Landfill Gas Monitoring Locations" dated 6 March 2012 (Whytes Gully New Landfill Cell EA - Volume IV). E298438 N6184381

Pollutant	Unit of measure	No. of samples required	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Methane	percent by volume					

Monitoring Point 26

Subsurface gas monitoring, Monitoring point labelled LFG MW6 on Figure 14 titled "Proposed Landfill Gas Monitoring Locations" dated 6 March 2012 (Whytes Gully New Landfill Cell EA - Volume IV). E298376 N6184303

Pollutant	Unit of measure	No. of samples required	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Methane	percent by volume					

Monitoring Point 27

Subsurface gas monitoring, Monitoring point labelled LFG MW7 on Figure 14 titled "Proposed Landfill Gas Monitoring Locations" dated 6 March 2012 (Whytes Gully New Landfill Cell EA - Volume IV). E298470 N6184553

Pollutant	Unit of measure	No. of samples required	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Methane	percent by volume					

Monitoring Point 28

Subsurface gas monitoring, Monitoring point labelled LFG MW8 on Figure 14 titled "Proposed Landfill Gas Monitoring Locations" dated 6 March 2012 (Whytes Gully New Landfill Cell EA - Volume IV). E298376 N6184303

Pollutant	Unit of measure	No. of samples required	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Methane	percent by volume					

Monitoring Point 29

Subsurface gas monitoring, Monitoring point labelled LFG MW9 on Figure 14 titled "Proposed Landfill Gas Monitoring Locations" dated 6 March 2012 (Whytes Gully New Landfill Cell EA - Volume IV). E298465 N6184645

Pollutant	Unit of measure	No. of samples required	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Methane	percent by volume					

Monitoring Point 30

Subsurface gas monitoring, Monitoring point labelled LFG MW10 on Figure 14 titled "Proposed Landfill Gas Monitoring Locations" dated 6 March 2012 (Whytes Gully New Landfill Cell EA - Volume IV). E298448 N6184684

Pollutant	Unit of measure	No. of samples required	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Methane	percent by volume					

Monitoring Point 31

Subsurface gas monitoring, Monitoring point labelled LFG MW11 on Figure 14 titled "Proposed Landfill Gas Monitoring Locations" dated 6 March 2012 (Whytes Gully New Landfill Cell EA - Volume IV). E298400 N6184695

Pollutant	Unit of measure	No. of samples required	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Methane	percent by volume					

Monitoring Point 32

Subsurface gas monitoring, Monitoring point labelled LFG MW12 on Figure 14 titled "Proposed Landfill Gas Monitoring Locations" dated 6 March 2012 (Whytes Gully New Landfill Cell EA - Volume IV). E298351 N6184701

Pollutant	Unit of measure	No. of samples required	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Methane	percent by volume					

Monitoring Point 33

Stormwater monitoring point, Downstream monitoring point labelled 4 on Figure 13 titled "Proposed Surface Water Monitoring Locations" dated 26 March 2012 (Whytes Gully New Landfill Cell EA - Volume IV). E297767 N6183396

Pollutant	Unit of measure	No. of samples required	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Alkalinity (as calcium carbonate)	milligrams per litre					
Ammonia	milligrams per litre					
Calcium	milligrams per litre					
Chloride	milligrams per litre					
Conductivity	microsiemens per centimetre					
Dissolved Oxygen	milligrams per litre					
Filterable iron	milligrams per litre					
Fluoride	milligrams per litre					
Magnesium	milligrams per litre					

Nitrate	milligrams per litre					
pH	pH					
Potassium	milligrams per litre					
Sodium	milligrams per litre					
Sulfate	milligrams per litre					
Temperature	degrees Celsius					
Total organic carbon	milligrams per litre					
Total Phenolics	milligrams per litre					
Total suspended solids	milligrams per litre					

Monitoring Point 34

Stormwater monitoring point, Upstream monitoring point labelled 6 on Figure 13 titled "Proposed Surface Water Monitoring Locations" dated 26 March 2012 (Whytes Gully New Landfill Cell EA - Volume IV). E297495 N6184504

Pollutant	Unit of measure	No. of samples required	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Alkalinity (as calcium carbonate)	milligrams per litre					
Ammonia	milligrams per litre					
Calcium	milligrams per litre					
Chloride	milligrams per litre					
Conductivity	microsiemens per centimetre					
Dissolved Oxygen	milligrams per litre					
Filterable iron	milligrams per litre					
Fluoride	milligrams per litre					
Magnesium	milligrams per litre					
Nitrate	milligrams per litre					
pH	pH					

Potassium	milligrams per litre					
Sodium	milligrams per litre					
Sulfate	milligrams per litre					
Temperature	degrees Celsius					
Total organic carbon	milligrams per litre					
Total Phenolics	milligrams per litre					
Total suspended solids	milligrams per litre					

Name of the uploaded file containing point data ▼
WG returns.xlsx

B3. Volume or Mass Monitoring Summary

For each volume or mass monitoring point identified in your licence, details are displayed below. If volume or mass monitoring is not required by your licence, **no data** will appear below.
If data was provided from an uploaded file, the file name will be displayed below instead of any data.
Note that this does not exclude the need to conduct appropriate volume or mass monitoring of assessable pollutants are required by load-based licensing (if applicable).

C. Statement of Compliance - Licence Conditions

C1. Compliance with Licence Conditions

Were all conditions of the licence complied with (including monitoring and reporting requirements)?	**Yes**

D. Statement of Compliance - Load Based Fee Calculation

If you are not required to monitor assessable pollutants by your licence, **no data** will appear below.

If assessable pollutants have been identified on your licence, the following worksheets for each assessable pollutant will determine your load based fee for the licence fee period to which this Annual Return relates.

Loads of assessable pollutants must be calculated using any of the methods provided in EPA's Load Calculation Protocol for the relevant activity. A Load Calculation Protocol would have been already sent to you with your licence. If you require additional copies, you can download the Protocol from the EPA's website or you can contact us on telephone 02 9995 5700.

You are required to keep all records used to calculate licence fees for four years after the licence fee was paid or became payable, whichever is the later date.

E. Statement of Compliance - Requirement to Prepare PIRMP

Have you prepared a Pollution Incident Response Management Plan (PIRMP) as required under section 153A of the Protection of the Environment Operations (POEO) Act 1997?	**Yes**
Is the PIRMP available at the premises?	**Yes**
Is the PIRMP available in a prominent position on a publicly accessible website?	**Yes**
Address of the web page where the PIRMP can be accessed ▼	
www.wollongong,nsw.gov.au	
Has the PIRMP been tested?	**Yes**
The PIRMP was last tested on	**4-3-2019**
Has the PIRMP been updated?	**Yes**
The PIRMP was last updated on	**30-6-2019**
Number of times the PIRMP was activated in this reporting period?	**1**
The PIRMP was activated on	**04/03/2019**

F. Statement of Compliance - Requirement to Publish Pollution Monitoring Data

Are there any conditions attached to your licence that require pollution monitoring to be undertaken as required under section 66(6) of the Protection of the Environment Operations (POEO) Act 1997?	**Yes**
Do you operate a website?	**Yes**
Is the pollution monitoring data published on your website in accordance with the EPA's written requirements for publishing pollution monitoring data?	**Yes**
Address of the web page where the pollution monitoring data can be accessed ▼	
www.wollongong.nsw.gov.au	

G. Statement of Compliance - Environment Management System and Practices

Do you have an ISO 14001 certified Environmental Management System (EMS) OR any other system that EPA considers is equivalent to the accountability, procedures, documentation and record keeping requirements of an ISO 14001 certified EMS?	**No**
Have you conducted an assessment of your activities and operations to identify the aspects that have a potential to cause environmental impacts and implemented operational controls to address these aspects?	**Yes**
Have you established and implemented an operational maintenance program, including preventative maintenance?	**Yes**
Do you keep records of regular inspections and maintenance of plant and equipment?	**Yes**
Do you conduct regular site audits to assess compliance with environmental legal requirements and assess conformance to the requirements of any documented environmental practices, procedures and systems in place?	**Yes**
Are the audits of documented environmental practices, procedures and systems undertaken by a third party?	**Yes**
Have you established and implemented an environmental improvement or management plan?	**Yes**
Do you train staff in environmental issues that may arise from your activities and operations and keep records of this	**Yes**

H. Signature and Certification

This Annual Return may only be signed by person(s) with legal authority to sign it as set out in following categories: an Individual, a Company, a Public authority or a Local council.

It is an offence to supply any information in this form that is false or misleading in a material respect, or to certify a statement that is false or misleading in a material respect. There is a maximum penalty of $250,000 for a corporation and $120,000 for an individual.

I/We

- declare that the information in the Monitoring and Complaints Summary in Section B of this Annual Return application is correct and not false or misleading in a material respect, and
- certify that the information in the Statement and Compliance in sections A, C, D, E, F, G and H and any other pages attached to Section C is correct and not false or misleading in a material respect.

Signature	
Name	24/9/09

Position	GENERAL MANAGER
Date	24 / 7 / 19

Declaration

I declare that the information in the Monitoring and Complaints Summary in section B of this Annual Return is correct and not false or misleading in a material respect, and

I certify that the information in the Statement of Compliance in section A,C,D,E,F and G and any pages attached to Section C is correct and not false or misleading in a material respect.

Whytes Gully

WG Concentration
Monitoring Summary
B2 29/5/2018-28/5/2019

For each monitoring point identified in your licence complete all the details for each pollutants listed in the tables provided below

Discharge & Monitoring Point 1

Stormwater monitoring and discharge point, Outlet at Reddalls Road - Monitoring point labelled 1 on Figure 13 titled 'Proposed Surface Water Monitoring Locations' dated 26 March 2012 (Whytes Gully New Landfill Cell EA - Volume IV) E297777 N6183972

Pollutant	Unit of Measure	No of samples required by licence	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Alkalinity (as calcium carbonate)	milligrams per litre	1	1	208	208	208
Ammonia	milligrams per litre	1	1	0.11	0.11	0.11
Calcium	milligrams per litre	1	1	49	49	49
Chloride	milligrams per litre	1	1	102	102	102
Conductivity	microsiemens per centimeter	1	1	719	719	719
Dissolved Oxygen	milligrams per litre	1	1	6.41	6.41	6.41
Filterable Iron	milligrams per litre	1	1	0.12	0.12	0.12
Fluoride	milligrams per litre	1	1	0.4	0.4	0.4
Magnesium	milligrams per litre	1	1	22	22	22
Nitrate	milligrams per litre	1	1	0.11	0.11	0.11
pH	pH	1	1	7.8	7.8	7.8
Potassium	milligrams per litre	1	1	3	3	3
Sodium	milligrams per litre	1	1	73	73	73
Sulfate	milligrams per litre	1	1	18	18	18
Temperature	milligrams per litre	1	1	20.1	20.1	20.1
Total Organic Carbon	milligrams per litre	1	1	11	11	11
Total Phenolics	milligrams per litre	1	1	0.05	0.05	0.05
Total suspended solids	milligrams per litre	1	1	21	21	21

note: No discharge when annual sampling conducted. Standing water sample only

Monitoring Point 10

Groundwater quality monitoring, Monitoring point labelled GMW103 on Figure 15 titled "Current Site Investigation Locations" dated 6

Pollutant	Unit of Measure	No of samples required by licence	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Alkalinity (as calcium carbonate)	milligrams per litre	4	4	372	415.75	462
Aluminium	milligrams per litre	1	1	3.19	3.19	3.19
Arsenic	milligrams per litre	1	1	0.001	0.001	0.001
Barium	milligrams per litre	1	1	0.026	0.026	0.026
Benzene	milligrams per litre	1	1	1	1	1
Cadmium	milligrams per litre	1	1	0.0001	0.0001	0.0001
Calcium	milligrams per litre	4	4	164	174	194
Chloride	milligrams per litre	4	4	305	368	482
Chromium (hexavalent)	milligrams per litre	1	1	0.01	0.01	0.01
Chromium (total)	milligrams per litre	1	1	0.004	0.004	0.004
Cobalt	milligrams per litre	1	1	0.006	0.006	0.006
Conductivity	microsiemens per centimeter	4	4	1820	1967.5	2160
Copper	milligrams per litre	1	1	0.011	0.011	0.011
Ethyl benzene	micrograms per litre	1	1	2	2	2
Fluoride	milligrams per litre	1	1	0.4	0.4	0.4
Lead	milligrams per litre	1	1	0.006	0.006	0.006
Magnesium	milligrams per litre	4	4	55	58.25	63
Manganese	micrograms per litre	1	1	0.141	0.141	0.141
Mercury	milligrams per litre	1	1	0.0001	0.0001	0.0001

Nitrate	milligrams per litre	1	1	0.01	0.01	0.01
Nitrite	milligrams per litre	1	1	0.26	0.26	0.26
Nitrogen (ammonia)	milligrams per litre	4	4	0.02	0.0375	0.06
Organochlorine pesticides	milligrams per litre	1	1	0.5	0.5	0.5
Organophosphate pesticides	milligrams per litre	1	1	0.5	0.5	0.5
pH	pH	4	4	7.1	7.2	7.4
Polycyclic aromatic hydrocarbons	milligrams per litre	1	1	1	1	1
Potassium	milligrams per litre	4	4	1	1	1
Sodium	milligrams per litre	4	4	162	162.5	165
Standing Water Level	meters	4	4	3.85	6.6975	7.87
Sulfate	milligrams per litre	4	4	76	127.25	158
Toluene	milligrams per litre	1	1	2	2	2
Total dissolved solids	milligrams per litre	4	4	978	1132	1280
Total organic carbon	milligrams per litre	4	4	1	1.5	2
Total petroleum hydrocarbons	milligrams per litre	1	1	50	50	50
Total Phenolics	milligrams per litre	1	1	0.05	0.05	0.05
Xylene	milligrams per litre	1	1	2	2	2
Zinc	milligrams per kilogram	1	1	0.027	0.027	0.027

Monitoring Point 11						
Groundwater quality monitoring, Monitoring point labelled GMW104 on Figure 15 titled "Current Site Investigation Locations" dated 6						
Pollutant	**Unit of Measure**	**No of samples required by licence**	**No. of samples collected and analysed**	**Lowest sample value**	**Mean of sample**	**Highest sample value**
Alkalinity (as calcium carbonate)	milligrams per litre	4	4	318	409.5	481
Aluminium	milligrams per litre	1	3	7.56	10.32	12.6
Arsenic	milligrams per litre	1	1	0.001	0.001	0.001
Barium	milligrams per litre	1	1	0.038	0.038	0.038
Benzene	milligrams per litre	1	1	1	1	1
Cadmium	milligrams per litre	1	1	0.0001	0.0001	0.0001
Calcium	milligrams per litre	4	4	47	61.5	73
Chloride	milligrams per litre	4	4	72	104.25	120
Chromium (hexavalent)	milligrams per litre	1	1	0.01	0.01	0.01
Chromium (total)	milligrams per litre	1	1	0.007	0.007	0.007
Cobalt	milligrams per litre	1	1	0.001	0.001	0.001
Conductivity	microsiemens per centimeter	4	4	1010	1227.5	1360
Copper	milligrams per litre	1	1	0.01	0.01	0.01
Ethyl benzene	micrograms per litre	1	1	2	2	2
Fluoride	milligrams per litre	1	1	0.8	0.8	0.8
Lead	milligrams per litre	1	1	0.007	0.007	0.007
Magnesium	milligrams per litre	4	4	30	38.5	46
Manganese	micrograms per litre	1	1	0.624	0.624	0.624
Mercury	milligrams per litre	1	1	0.0001	0.0001	0.0001
Nitrate	milligrams per litre	1	1	0.03	0.03	0.03
Nitrite	milligrams per litre	1	1	0.01	0.01	0.01
Nitrogen (ammonia)	milligrams per litre	4	4	0.02	0.0275	0.03
Organochlorine pesticides	milligrams per litre	1	1	0.5	0.5	0.5
Organophosphate pesticides	milligrams per litre	1	1	0.5	0.5	0.5
pH	pH	4	4	7.2	7.375	7.4
Polycyclic aromatic hydrocarbons	milligrams per litre	1	1	1	1	1
Potassium	milligrams per litre	4	4	1	1.25	2
Sodium	milligrams per litre	4	4	132	156.75	167
Standing Water Level	meters	4	4	3.32	6.74	8.06
Sulfate	milligrams per litre	4	4	46	59	67
Toluene	milligrams per litre	1	1	2	2	2

Total dissolved solids	milligrams per litre	4	4	616	692.25	774
Total organic carbon	milligrams per litre	4	4	1	1.75	3
Total petroleum hydrocarbons	milligrams per litre	1	1	50	50	50
Total Phenolics	milligrams per litre	1	1	0.05	0.05	0.05
Xylene	milligrams per litre	1	1	2	2	2
Zinc	milligrams per kilogram	1	1	0.044	0.044	0.044

Monitoring Point 12						
Groundwater quality monitoring, Monitoring point labelled GMW105 on Figure 15 titled "Current Site Investigation Locations" dated 6						
Pollutant	**Unit of Measure**	**No of samples required by licence**	**No. of samples collected and analysed**	**Lowest sample value**	**Mean of sample**	**Highest sample value**
Alkalinity (as calcium carbonate)	milligrams per litre	4	4	DRY	DRY	DRY
Aluminium	milligrams per litre	1	1	DRY	DRY	DRY
Arsenic	milligrams per litre	1	1	DRY	DRY	DRY
Barium	milligrams per litre	1	1	DRY	DRY	DRY
Benzene	milligrams per litre	1	1	DRY	DRY	DRY
Cadmium	milligrams per litre	1	1	DRY	DRY	DRY
Calcium	milligrams per litre	4	4	DRY	DRY	DRY
Chloride	milligrams per litre	4	4	DRY	DRY	DRY
Chromium (hexavalent)	milligrams per litre	1	1	DRY	DRY	DRY
Chromium (total)	milligrams per litre	1	1	DRY	DRY	DRY
Cobalt	milligrams per litre	1	1	DRY	DRY	DRY
Conductivity	microsiemens per centimeter	4	4	DRY	DRY	DRY
Copper	milligrams per litre	1	1	DRY	DRY	DRY
Ethyl benzene	micrograms per litre	1	1	DRY	DRY	DRY
Fluoride	milligrams per litre	1	1	DRY	DRY	DRY
Lead	milligrams per litre	1	1	DRY	DRY	DRY
Magnesium	milligrams per litre	4	4	DRY	DRY	DRY
Manganese	micrograms per litre	1	1	DRY	DRY	DRY
Mercury	milligrams per litre	1	1	DRY	DRY	DRY
Nitrate	milligrams per litre	1	1	DRY	DRY	DRY
Nitrite	milligrams per litre	1	1	DRY	DRY	DRY
Nitrogen (ammonia)	milligrams per litre	4	4	DRY	DRY	DRY
Organochlorine pesticides	milligrams per litre	1	1	DRY	DRY	DRY
Organophosphate pesticides	milligrams per litre	1	1	DRY	DRY	DRY
pH	pH	4	4	DRY	DRY	DRY
Polycyclic aromatic hydrocarbons	milligrams per litre	1	1	DRY	DRY	DRY
Potassium	milligrams per litre	4	4	DRY	DRY	DRY
Sodium	milligrams per litre	4	4	DRY	DRY	DRY
Standing Water Level	meters	4	4	DRY	DRY	DRY
Sulfate	milligrams per litre	4	4	DRY	DRY	DRY
Toluene	milligrams per litre	1	1	DRY	DRY	DRY
Total dissolved solids	milligrams per litre	4	4	DRY	DRY	DRY
Total organic carbon	milligrams per litre	4	4	DRY	DRY	DRY
Total petroleum hydrocarbons	milligrams per litre	1	1	DRY	DRY	DRY
Total Phenolics	milligrams per litre	1	1	DRY	DRY	DRY
Xylene	milligrams per litre	1	1	DRY	DRY	DRY
Zinc	milligrams per kilogram	1	1	DRY	DRY	DRY

Monitoring Point 13						
Groundwater quality monitoring, Monitoring point labelled GMW106 on Figure 15 titled "Current Site Investigation Locations" dated 6						
Pollutant	**Unit of Measure**	**No of samples required by licence**	**No. of samples collected and analysed**	**Lowest sample value**	**Mean of sample**	**Highest sample value**

Alkalinity (as calcium carbonate)	milligrams per litre	4	4	DRY	DRY	DRY
Aluminium	milligrams per litre	1	1	DRY	DRY	DRY
Arsenic	milligrams per litre	1	1	DRY	DRY	DRY
Barium	milligrams per litre	1	1	DRY	DRY	DRY
Benzene	milligrams per litre	1	1	DRY	DRY	DRY
Cadmium	milligrams per litre	1	1	DRY	DRY	DRY
Calcium	milligrams per litre	4	4	DRY	DRY	DRY
Chloride	milligrams per litre	4	4	DRY	DRY	DRY
Chromium (hexavalent)	milligrams per litre	1	1	DRY	DRY	DRY
Chromium (total)	milligrams per litre	1	1	DRY	DRY	DRY
Cobalt	milligrams per litre	1	1	DRY	DRY	DRY
Conductivity	microsiemens per centimeter	4	4	DRY	DRY	DRY
Copper		1	1	DRY	DRY	DRY
Ethyl benzene	micrograms per litre	1	1	DRY	DRY	DRY
Fluoride	milligrams per litre	1	1	DRY	DRY	DRY
Lead	milligrams per litre	1	1	DRY	DRY	DRY
Magnesium	milligrams per litre	4	4	DRY	DRY	DRY
Manganese	micrograms per litre	1	1	DRY	DRY	DRY
Mercury	milligrams per litre	1	1	DRY	DRY	DRY
Nitrate	milligrams per litre	1	1	DRY	DRY	DRY
Nitrite	milligrams per litre	1	1	DRY	DRY	DRY
Nitrogen (ammonia)	milligrams per litre	4	4	DRY	DRY	DRY
Organochlorine pesticides	milligrams per litre	1	1	DRY	DRY	DRY
Organophosphate pesticides	milligrams per litre	1	1	DRY	DRY	DRY
pH	pH	4	4	DRY	DRY	DRY
Polycyclic aromatic hydrocarbons	milligrams per litre	1	1	DRY	DRY	DRY
Potassium	milligrams per litre	4	4	DRY	DRY	DRY
Sodium	milligrams per litre	4	4	DRY	DRY	DRY
Standing Water Level	meters	4	4	DRY	DRY	DRY
Sulfate	milligrams per litre	4	4	DRY	DRY	DRY
Toluene	milligrams per litre	1	1	DRY	DRY	DRY
Total dissolved solids	milligrams per litre	4	4	DRY	DRY	DRY
Total organic carbon	milligrams per litre	4	4	DRY	DRY	DRY
Total petroleum hydrocarbons	milligrams per litre	1	1	DRY	DRY	DRY
Total Phenolics	milligrams per litre	1	1	DRY	DRY	DRY
Xylene	milligrams per litre	1	1	DRY	DRY	DRY
Zinc	milligrams per kilogram	1	1	DRY	DRY	DRY

Monitoring Point 14						
Groundwater quality monitoring, Monitoring point labelled GMW108S on Figure 15 titled "Current Site Investigation Locations" dated 6						
Pollutant	**Unit of Measure**	**No of samples required by licence**	**No. of samples collected and analysed**	**Lowest sample value**	**Mean of sample**	**Highest sample value**
Alkalinity (as calcium carbonate)	milligrams per litre	4	4	319	351.25	447
Aluminium	milligrams per litre	1	1	11.9	11.9	11.9
Arsenic	milligrams per litre	1	1	0.001	0.001	0.001
Barium	milligrams per litre	1	1	0.209	0.209	0.209
Benzene	milligrams per litre	1	1	1	1	1
Cadmium	milligrams per litre	1	1	0.0001	0.0001	0.0001
Calcium	milligrams per litre	4	4	88	89.75	112
Chloride	milligrams per litre	4	4	242	375	577
Chromium (hexavalent)	milligrams per litre	1	1	0.01	0.01	0.01
Chromium (total)	milligrams per litre	1	1	0.01	0.01	0.01
Cobalt	milligrams per litre	1	1	0.009	0.009	0.009
Conductivity	microsiemens per centimeter	4	4	1460	1955	2770
Copper	milligrams per litre	1	1	0.039	0.039	0.039
Ethyl benzene	micrograms per litre	1	1	2	2	2

Fluoride	milligrams per litre	1	1	0.4	0.4	0.4
Lead	milligrams per litre	1	1	0.047	0.047	0.047
Magnesium	milligrams per litre	4	4	39	55	75
Manganese	micrograms per litre	1	1	0.442	0.442	0.442
Mercury	milligrams per litre	1	1	0.0001	0.0001	0.0001
Nitrate	milligrams per litre	1	1	0.01	0.01	0.01
Nitrite	milligrams per litre	1	1	0.01	0.01	0.01
Nitrogen (ammonia)	milligrams per litre	4	4	0.08	0.14	0.21
Organochlorine pesticides	milligrams per litre	1	1	0.5	0.5	0.5
Organophosphate pesticides	milligrams per litre	1	1	0.5	0.5	0.5
pH	pH	4	4	2	4.5	6
Polycyclic aromatic hydrocarbons	milligrams per litre	1	1	1	1	1
Potassium	milligrams per litre	4	4	2	4.5	6
Sodium	milligrams per litre	4	4	170	224.25	313
Standing Water Level	meters	4	4	2.94	3.155	3.5
Sulfate	milligrams per litre	4	4	68	109.75	165
Toluene	milligrams per litre	1	1	2	2	2
Total dissolved solids	milligrams per litre	4	4	836	1202	1610
Total organic carbon	milligrams per litre	4	4	4	6.25	12
Total petroleum hydrocarbons	milligrams per litre	1	1	50	50	50
Total Phenolics	milligrams per litre	1	1	0.05	0.05	0.05
Xylene	milligrams per litre	1	1	2	2	2
Zinc	milligrams per kilogram	1	1	0.047	0.047	0.047

Monitoring Point 15						
Groundwater quality monitoring. Monitoring point labelled GMW108D on Figure 15 titled "Current Site Investigation Locations" dated 6						
Pollutant	**Unit of Measure**	**No of samples required by licence**	**No. of samples collected and analysed**	**Lowest sample value**	**Mean of sample**	**Highest sample value**
Alkalinity (as calcium carbonate)	milligrams per litre	4	4	408	448	490
Aluminium	milligrams per litre	1	1	0.09	0.09	0.09
Arsenic	milligrams per litre	1	1	0.001	0.001	0.001
Barium	milligrams per litre	1	1	0.017	0.017	0.017
Benzene	milligrams per litre	1	1	1	1	1
Cadmium	milligrams per litre	1	1	0.0001	0.0001	0.0001
Calcium	milligrams per litre	4	4	128	129.25	130
Chloride	milligrams per litre	4	4	661	700.5	739
Chromium (hexavalent)	milligrams per litre	1	1	0.01	0.01	0.01
Chromium (total)	milligrams per litre	1	1	0.001	0.001	0.001
Cobalt	milligrams per litre	1	1	0.001	0.001	0.001
Conductivity	microsiemens per centimeter	4	4	3160	3240	3380
Copper	milligrams per litre	1	1	0.001	0.001	0.001
Ethyl benzene	micrograms per litre	1	1	2	2	2
Fluoride	milligrams per litre	1	1	0.7	0.7	0.7
Lead	milligrams per litre	1	1	0.001	0.001	0.001
Magnesium	milligrams per litre	4	4	82	84.75	88
Manganese	micrograms per litre	1	1	0.031	0.031	0.031
Mercury	milligrams per litre	1	1	0.0001	0.0001	0.0001
Nitrate	milligrams per litre	1	1	0.01	0.01	0.01
Nitrite	milligrams per litre	1	1	0.01	0.01	0.01
Nitrogen (ammonia)	milligrams per litre	4	4	0.02	0.44	0.34
Organochlorine pesticides	milligrams per litre	1	1	0.5	0.5	0.5
Organophosphate pesticides	milligrams per litre	1	1	0.5	0.5	0.5
pH	pH	4	4	6.8	6.925	7
Polycyclic aromatic hydrocarbons	milligrams per litre	1	1	1	1	1
Potassium	milligrams per litre	4	4	1	1.5	2

Sodium	milligrams per litre	4	4	396	406.25	416
Standing Water Level	meters	4	4	2.51	2.64	2.75
Sulfate	milligrams per litre	4	4	189	208	247
Toluene	milligrams per litre	1	1	2	2	2
Total dissolved solids	milligrams per litre	4	4	1670	1792.5	1870
Total organic carbon	milligrams per litre	4	4	1	1.75	3
Total petroleum hydrocarbons	milligrams per litre	1	1	50	50	50
Total Phenolics	milligrams per litre	1	1	0.05	0.05	0.05
Xylene	milligrams per litre	1	1	2	2	2
Zinc	milligrams per kilogram	1	1	0.005	0.005	0.005

Monitoring Point 16

Groundwater quality monitoring, Monitoring point labelled GMW109S on Figure 15 titled "Current Site Investigation Locations" dated 6

Pollutant	Unit of Measure	No of samples required by licence	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Alkalinity (as calcium carbonate)	milligrams per litre	4	4	195	220.75	254
Aluminium	milligrams per litre	1	1	2.31	2.31	2.31
Arsenic	milligrams per litre	1	1	0.001	0.001	0.001
Barium	milligrams per litre	1	1	0.068	0.068	0.068
Benzene	milligrams per litre	1	1	1	1	1
Cadmium	milligrams per litre	1	1	0.0001	0.0001	0.0001
Calcium	milligrams per litre	4	4	28	65	78
Chloride	milligrams per litre	4	4	299	335	368
Chromium (hexavalent)	milligrams per litre	1	1	0.01	0.01	0.01
Chromium (total)	milligrams per litre	1	1	0.003	0.003	0.003
Cobalt	milligrams per litre	1	1	0.016	0.016	0.016
Conductivity	microsiemens per centimeter	4	4	1460.00	1562.50	1630
Copper	milligrams per litre	1	1	0.009	0.009	0.009
Ethyl benzene	micrograms per litre	1	1	2	2	2
Fluoride	milligrams per litre	1	1	0.1	0.1	0.1
Lead	milligrams per litre	1	1	0.004	0.004	0.004
Magnesium	milligrams per litre	4	4	18	41.5	51
Manganese	micrograms per litre	1	3	1.33	2.47	4.62
Mercury	milligrams per litre	1	1	0.0001	0.0001	0.0001
Nitrate	milligrams per litre	1	1	0.01	0.01	0.01
Nitrite	milligrams per litre	1	1	0.01	0.01	0.01
Nitrogen (ammonia)	milligrams per litre	4	4	0.34	0.4825	0.66
Organochlorine pesticides	milligrams per litre	1	1	0.5	0.5	0.5
Organophosphate pesticides	milligrams per litre	1	1	0.5	0.5	0.5
pH	pH	4	4	6.2	6.325	6.5
Polycyclic aromatic hydrocarbons	milligrams per litre	1	1	1	1	1
Potassium	milligrams per litre	4	4	1	1.75	2
Sodium	milligrams per litre	4	4	61	136.25	168
Standing Water Level	meters	4	4	3.29	3.485	3.63
Sulfate	milligrams per litre	4	4	95	113.5	135
Toluene	milligrams per litre	1	1	2	2	2
Total dissolved solids	milligrams per litre	4	4	814	881.75	974
Total organic carbon	milligrams per litre	4	4	1	4	8
Total petroleum hydrocarbons	milligrams per litre	1	1	50	50	50
Total Phenolics	milligrams per litre	1	1	0.05	0.05	0.05
Xylene	milligrams per litre	1	1	2	2	2
Zinc	milligrams per kilogram	1	3	0.023	0.0515	0.109

Monitoring Point 17						
Groundwater quality monitoring, Monitoring point labelled GMW110 on Figure 15 titled "Current Site Investigation Locations" dated 6						
Pollutant	Unit of Measure	No of samples required by licence	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Alkalinity (as calcium carbonate)	milligrams per litre	4	4	506	560.5	618
Aluminium	milligrams per litre	1	1	2.29	2.29	2.29
Arsenic	milligrams per litre	1	1	0.001	0.001	0.001
Barium	milligrams per litre	1	1	0.008	0.008	0.008
Benzene	milligrams per litre	1	1	1	1	1
Cadmium	milligrams per litre	1	1	0.0001	0.0001	0.0001
Calcium	milligrams per litre	4	4	204	208.75	212
Chloride	milligrams per litre	4	4	942	1224.5	1910
Chromium (hexavalent)	milligrams per litre	1	1	0.01	0.01	0.01
Chromium (total)	milligrams per litre	1	1	0.002	0.002	0.002
Cobalt	milligrams per litre	1	1	0.002	0.002	0.002
Conductivity	microsiemens per centimeter	4	4	4340	4450	4710
Copper	milligrams per litre	1	1	0.011	0.011	0.011
Ethyl benzene	micrograms per litre	1	1	2	2	2
Fluoride	milligrams per litre	1	1	0.5	0.5	0.5
Lead	milligrams per litre	1	1	0.003	0.003	0.003
Magnesium	milligrams per litre	4	4	153	157.5	162
Manganese	micrograms per litre	1	1	0.098	0.098	0.098
Mercury	milligrams per litre	1	1	0.0001	0.0001	0.0001
Nitrate	milligrams per litre	1	1	0.57	0.57	0.57
Nitrite	milligrams per litre	1	1	0.01	0.01	0.01
Nitrogen (ammonia)	milligrams per litre	4	4	0.01	0.0175	0.02
Organochlorine pesticides	milligrams per litre	1	1	0.5	0.5	0.5
Organophosphate pesticides	milligrams per litre	1	1	0.5	0.5	0.5
pH	pH	4	4	6.8	6.85	6.9
Polycyclic aromatic hydrocarbons	milligrams per litre	1	1	1	1	1
Potassium	milligrams per litre	4	4	1	1.75	2
Sodium	milligrams per litre	4	4	454	464.25	480
Standing Water Level	meters	4	4	4.25	4.355	4.47
Sulfate	milligrams per litre	4	4	286	334.75	400
Toluene	milligrams per litre	1	1	2	2	2
Total dissolved solids	milligrams per litre	4	4	2350	2587.5	2820
Total organic carbon	milligrams per litre	4	4	1	2.75	7
Total petroleum hydrocarbons	milligrams per litre	1	1	50	50	50
Total Phenolics	milligrams per litre	1	1	0.05	0.05	0.05
Xylene	milligrams per litre	1	1	2	2	2
Zinc	milligrams per kilogram	1	1	0.021	0.021	0.021

Monitoring Point 18						
Groundwater quality monitoring, Monitoring point labelled GMW111 on Figure 15 titled "Current Site Investigation Locations" dated 6						
Pollutant	Unit of Measure	No of samples required by licence	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Alkalinity (as calcium carbonate)	milligrams per litre	4	4	450	521.5	610
Aluminium	milligrams per litre	1	1	6.29	6.29	6.29
Arsenic	milligrams per litre	1	1	0.001	0.001	0.001
Barium	milligrams per litre	1	1	0.031	0.031	0.031
Benzene	milligrams per litre	1	1	1	1	1
Cadmium	milligrams per litre	1	1	0.0001	0.0001	0.0001
Calcium	milligrams per litre	4	4	114	124.75	134
Chloride	milligrams per litre	4	4	700	733.75	800

Chromium (hexavalent)	milligrams per litre	1	1	0.01	0.01	0.01
Chromium (total)	milligrams per litre	1	1	0.004	0.004	0.004
Cobalt	milligrams per litre	1	1	0.007	0.007	0.007
Conductivity	microsiemens per centimeter	4	4	3210	3400	3670
Copper	milligrams per litre	1	1	0.016	0.016	0.016
Ethyl benzene	micrograms per litre	1	1	2	2	2
Fluoride	milligrams per litre	1	1	0.5	0.5	0.5
Lead	milligrams per litre	1	1	0.007	0.007	0.007
Magnesium	milligrams per litre	4	4	93	98	101
Manganese	micrograms per litre	1	1	0.369	0.369	0.369
Mercury	milligrams per litre	1	1	0.0001	0.0001	0.0001
Nitrate	milligrams per litre	1	1	0.01	0.01	0.01
Nitrite	milligrams per litre	1	1	0.01	0.01	0.01
Nitrogen (ammonia)	milligrams per litre	4	4	0.01	0.02	0.03
Organochlorine pesticides	milligrams per litre	1	1	0.5	0.5	0.5
Organophosphate pesticides	milligrams per litre	1	1	0.5	0.5	0.5
pH	pH	4	4	6.8	7	7.1
Polycyclic aromatic hydrocarbons	milligrams per litre	1	1	1	1	1
Potassium	milligrams per litre	4	4	1	1	1
Sodium	milligrams per litre	4	4	409	415.75	420
Standing Water Level	meters	4	4	5.88	6.3325	6.55
Sulfate	milligrams per litre	4	4	108	187.75	246
Toluene	milligrams per litre	1	1	2	2	2
Total dissolved solids	milligrams per litre	4	4	1650	1830	1930
Total organic carbon	milligrams per litre	4	4	1	1.25	2
Total petroleum hydrocarbons	milligrams per litre	1	1	50	50	50
Total Phenolics	milligrams per litre	1	1	0.05	0.05	0.05
Xylene	milligrams per litre	1	1	2	2	2
Zinc	milligrams per kilogram	1	1	0.036	0.036	0.036

Monitoring Point 19

Groundwater quality monitoring, Monitoring point labelled GMW109D on Figure 15 titled "Current Site Investigation Locations" dated 6 March 2012 (Whytes Gully New Landfill Cell EA - Volume IV). E297604.9 N6184068

Pollutant	Unit of Measure	No of samples required by licence	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Alkalinity (as calcium carbonate)	milligrams per litre	4	4	200	218.5	234
Aluminium	milligrams per litre	1	1	0.05	0.05	0.05
Arsenic	milligrams per litre	1	1	0.001	0.001	0.001
Barium	milligrams per litre	1	1	0.146	0.146	0.146
Benzene	milligrams per litre	1	1	1	1	1
Cadmium	milligrams per litre	1	1	0.0001	0.0001	0.0001
Calcium	milligrams per litre	4	4	92	95.75	98
Chloride	milligrams per litre	4	4	359	450.5	492
Chromium (hexavalent)	milligrams per litre	1	1	0.01	0.01	0.01
Chromium (total)	milligrams per litre	1	1	0.01	0.01	0.01
Cobalt	milligrams per litre	1	1	0.001	0.001	0.001
Conductivity	microsiemens per centimeter	4	4	1820	1830	1840
Copper	milligrams per litre	1	1	0.003	0.003	0.003
Ethyl benzene	micrograms per litre	1	1	2	2	2
Fluoride	milligrams per litre	1	1	0.4	0.4	0.4
Lead	milligrams per litre	1	1	0.001	0.001	0.001
Magnesium	milligrams per litre	4	4	48	49.25	50
Manganese	micrograms per litre	1	1	0.053	0.053	0.053
Mercury	milligrams per litre	1	1	0.0001	0.0001	0.0001
Nitrate	milligrams per litre	1	1	0.71	0.71	0.71
Nitrite	milligrams per litre	1	1	0.01	0.01	0.01

Nitrogen (ammonia)	milligrams per litre	4	4	0.03	0.085	0.11
Organochlorine pesticides	milligrams per litre	1	1	0.5	0.5	0.5
Organophosphate pesticides	milligrams per litre	1	1	0.5	0.5	0.5
pH	pH	4	4	6.9	6.95	7.1
Polycyclic aromatic hydrocarbons	milligrams per litre	1	1	1	1	1
Potassium	milligrams per litre	4	4	1	1	1
Sodium	milligrams per litre	4	4	186	188	190
Standing Water Level	meters	4	4	3.17	3.28	3.38
Sulfate	milligrams per litre	4	4	21	23.25	25
Toluene	milligrams per litre	1	1	2	2	2
Total dissolved solids	milligrams per litre	4	4	994	1116	1260
Total organic carbon	milligrams per litre	4	4	1	1	1
Total petroleum hydrocarbons	milligrams per litre	1	1	50	50	50
Total Phenolics	milligrams per litre	1	1	0.05	0.05	0.05
Xylene	milligrams per litre	1	1	2	2	2
Zinc	milligrams per kilogram	1	1	0.006	0.006	0.006

Monitoring Point 20						
Groundwater quality monitoring, Monitoring point labelled BH6 on Figure 15 titled "Current Site Investigation Locations" dated 6 March						
Pollutant	**Unit of Measure**	**No of samples required by licence**	**No. of samples collected and analysed**	**Lowest sample value**	**Mean of sample**	**Highest sample value**
Alkalinity (as calcium carbonate)	milligrams per litre	4	4	426	569.25	650
Aluminium	milligrams per litre	1	1	0.65	0.65	0.65
Arsenic	milligrams per litre	1	1	0.005	0.005	0.005
Barium	milligrams per litre	1	1	0.09	0.09	0.09
Benzene	milligrams per litre	1	1	1	1	1
Cadmium	milligrams per litre	1	1	0.0001	0.0001	0.0001
Calcium	milligrams per litre	4	4	73	102.5	118
Chloride	milligrams per litre	4	4	66	469.5	1120
Chromium (hexavalent)	milligrams per litre	1	1	0.01	0.01	0.01
Chromium (total)	milligrams per litre	1	1	0.002	0.002	0.002
Cobalt	milligrams per litre	1	1	0.008	0.008	0.008
Conductivity	microsiemens per centimeter	4	4	1180	2647.5	5060
Copper	milligrams per litre	1	1	0.011	0.011	0.011
Ethyl benzene	micrograms per litre	1	1	2	2	2
Fluoride	milligrams per litre	1	1	0.6	0.6	0.6
Lead	milligrams per litre	1	1	0.009	0.009	0.009
Magnesium	milligrams per litre	4	4	33	67	19
Manganese	micrograms per litre	1	1	0.87	0.87	0.87
Mercury	milligrams per litre	1	1	0.0001	0.0001	0.0001
Nitrate	milligrams per litre	1	1	0.02	0.02	0.02
Nitrite	milligrams per litre	1	1	0.02	0.02	0.02
Nitrogen (ammonia)	milligrams per litre	4	4	0.2	0.28	0.44
Organochlorine pesticides	milligrams per litre	1	1	0.5	0.5	0.5
Organophosphate pesticides	milligrams per litre	1	1	0.5	0.5	0.5
pH	pH	4	4	6.9	7	7.1
Polycyclic aromatic hydrocarbons	milligrams per litre	1	1	1	1	1
Potassium	milligrams per litre	4	4	1	4.25	9
Sodium	milligrams per litre	4	4	119	367	747
Standing Water Level	meters	4	4	1.63	1.805	2.03

Sulfate	milligrams per litre	4	4	117	212	315
Toluene	milligrams per litre	1	1	2	2	2
Total dissolved solids	milligrams per litre	4	4	744	1483.5	2520
Total organic carbon	milligrams per litre	4	4	6	19.5	31
Total petroleum hydrocarbons	milligrams per litre	1	1	50	50	50
Total Phenolics	milligrams per litre	1	1	0.05	0.05	0.05
Xylene	milligrams per litre	1	1	2	2	2
Zinc	milligrams per kilogram	1	1	0.017	0.017	0.017

Monitoring Point 21

Subsurface gas monitoring, Monitoring point labelled LFG MW1 on Figure 14 titled "Proposed Landfill Gas Monitoring Locations" dated

Pollutant	Unit of Measure	No of samples required by licence	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Methane	percent by volume	12	12	0	0.0667	0.1

Monitoring Point 22

Subsurface gas monitoring, Monitoring point labelled LFG MW2 on Figure 14 titled "Proposed Landfill Gas Monitoring Locations" dated

Pollutant	Unit of Measure	No of samples required by licence	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Methane	percent by volume	12	12	0	0.0667	0.1

Monitoring Point 23

Subsurface gas monitoring, Monitoring point labelled LFG MW3 on Figure 14 titled "Proposed Landfill Gas Monitoring Locations" dated

Pollutant	Unit of Measure	No of samples required by licence	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Methane	percent by volume	12	12	0	0.0667	0.1

Monitoring Point 24

Subsurface gas monitoring, Monitoring point labelled LFG MW4 on Figure 14 titled "Proposed Landfill Gas Monitoring Locations" dated

Pollutant	Unit of Measure	No of samples required by licence	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Methane	percent by volume	12	12	0	0.1752	0.1

Monitoring Point 25

Subsurface gas monitoring, Monitoring point labelled LFG MW5 on Figure 14 titled "Proposed Landfill Gas Monitoring Locations" dated

Pollutant	Unit of Measure	No of samples required by licence	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Methane	percent by volume	12	12	0	0.06675	0.1

Monitoring Point 26

Subsurface gas monitoring, Monitoring point labelled LFG MW6 on Figure 14 titled "Proposed Landfill Gas Monitoring Locations" dated

Pollutant	Unit of Measure	No of samples required by licence	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Methane	percent by volume	12	12	0	0.0584	0.1

Monitoring Point 27

Subsurface gas monitoring, Monitoring point labelled LFG MW7 on Figure 14 titled "Proposed Landfill Gas Monitoring Locations" dated

Pollutant	Unit of Measure	No of samples required by licence	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Methane	percent by volume	12	12	0	0.0669	0.1

Monitoring Point 28

Subsurface gas monitoring, Monitoring point labelled LFG MW8 on Figure 14 titled "Proposed Landfill Gas Monitoring Locations" dated

Pollutant	Unit of Measure	No of samples required by licence	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Methane	percent by volume	12	12	0	0.06765	0.1

Monitoring Point 29

Subsurface gas monitoring, Monitoring point labelled LFG MW9 on Figure 14 titled "Proposed Landfill Gas Monitoring Locations" dated						
Pollutant	Unit of Measure	No of samples required by licence	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Methane	percent by volume	12	12	0	0.0668	0.1

Monitoring Point 3						
Surface Gas Monitoring. Areas where intermediate or final cover has been placed						
Pollutant	Unit of Measure	No of samples required by licence	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Methane	percent by volume	12	12	0	0.64	4.1

Monitoring Point 30						
Subsurface gas monitoring, Monitoring point labelled LFG MW10 on Figure 14 titled "Proposed Landfill Gas Monitoring Locations" dated						
Pollutant	Unit of Measure	No of samples required by licence	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Methane	percent by volume	12	12	0	0.0666	0.1

Monitoring Point 31						
Subsurface gas monitoring, Monitoring point labelled LFG MW11 on Figure 14 titled "Proposed Landfill Gas Monitoring Locations" dated						
Pollutant	Unit of Measure	No of samples required by licence	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Methane	percent by volume	12	12	0	0.0666	0.1

Monitoring Point 32						
Subsurface gas monitoring, Monitoring point labelled LFG MW12 on Figure 14 titled "Proposed Landfill Gas Monitoring Locations" dated						
Pollutant	Unit of Measure	No of samples required by licence	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Methane	percent by volume	12	12	0	0.0666	0.1

Monitoring Point 33						
Stormwater monitoring point, Downstream monitoring point labelled 4 on Figure 13 titled "Proposed Surface Water Monitoring						
Pollutant	Unit of Measure	No of samples required by licence	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Alkalinity (as calcium carbonate)	milligrams per litre	1	1	92	92	92
Ammonia	milligrams per litre	1	1	0.05	0.05	0.05
Calcium	milligrams per litre	1	1	15	15	15
Chloride	milligrams per litre	1	1	19	19	19
Conductivity	microsiemens per centimeter	1	1	201	201	201
Dissolved Oxygen	milligrams per litre	1	1	5.2	5.2	5.2
Filterable Iron	milligrams per litre	1	1	0.27	0.27	0.27
Fluoride	milligrams per litre	1	1	0.1	0.1	0.1
Magnesium	milligrams per litre	1	1	4	4	4
Nitrate	milligrams per litre	1	1	0.03	0.03	0.03
pH	pH	1	1	7.1	7.1	7.1
Potassium	milligrams per litre	1	1	2	2	2
Sodium	milligrams per litre	1	1	21	21	21
Sulfate	milligrams per litre	1	1	12	12	12
Temperature	milligrams per litre	1	1	21.1	21.1	21.1
Total Organic Carbon	milligrams per litre	1	1	6	6	6
Total Phenolics	milligrams per litre	1	1	0.05	0.05	0.05
Total suspended solids	milligrams per litre	1	1	10	10	10

Monitoring Point 34						
Stormwater monitoring point, Upstream monitoring point labelled 6 on Figure 13 titled "Proposed Surface Water Monitoring Locations"						
Pollutant	Unit of Measure	No of samples required by licence	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Alkalinity (as calcium carbonate)	milligrams per litre	1	1	202	202	202
Ammonia	milligrams per litre	1	1	0.02	0.02	0.02

Calcium	milligrams per litre	1	1	48	48	48
Chloride	milligrams per litre	1	1	49	49	49
Conductivity	microsiemens per centimeter	1	1	551	551	551
Dissolved Oxygen	milligrams per litre	1	1	4.31	4.31	4.31
Filterable Iron	milligrams per litre	1	1	0.09	0.09	0.09
Fluoride	milligrams per litre	1	1	0.2	0.2	0.2
Magnesium	milligrams per litre	1	1	21	21	21
Nitrate	milligrams per litre	1	1	0.01	0.01	0.01
pH	pH	1	1	7.4	7.4	7.4
Potassium	milligrams per litre	1	1	4	4	4
Sodium	milligrams per litre	1	1	42	42	42
Sulfate	milligrams per litre	1	1	23	23	23
Temperature	milligrams per litre	1	1	19.7	19.7	19.7
Total Organic Carbon	milligrams per litre	1	1	7	7	7
Total Phenolics	milligrams per litre	1	1	0.05	0.05	0.05
Total suspended solids	milligrams per litre	1	1	9	9	9

Monitoring Point 4						
Gas accumulation monitoring, Inside all buildings within 250 meters of deposited waste						
Pollutant	Unit of Measure	No of samples required by licence	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Methane	percent by volume	12	12	0	0.78	6.1

Monitoring Point 5						
Groundwater quality monitoring , Monitoring point labelled GABH02 on Figure 15 titled "Current Site Investigation Locations" dated 6						
Pollutant	Unit of Measure	No of samples required by licence	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Alkalinity (as calcium carbonate)	milligrams per litre	4	4	870	1020.75	1130
Aluminium	milligrams per litre	1	1	6.61	6.61	6.61
Arsenic	milligrams per litre	1	1	0.001	0.001	0.001
Barium	milligrams per litre	1	1	0.015	0.015	0.015
Benzene	milligrams per litre	1	1	1	1	1
Cadmium	milligrams per litre	1	1	0.0001	0.0001	0.0001
Calcium	milligrams per litre	4	4	295	304.5	310
Chloride	milligrams per litre	4	4	1180	1212.5	1270
Chromium (hexavalent)	milligrams per litre	1	1	0.01	0.01	0.01
Chromium (total)	milligrams per litre	1	1	0.005	0.005	0.005
Cobalt	milligrams per litre	1	1	0.002	0.002	0.002
Conductivity	microsiemens per centimeter	4	4	5429	5570	5940
Copper	milligrams per litre	1	1	0.015	0.015	0.015
Ethyl benzene	micrograms per litre	1	1	2	2	2
Fluoride	milligrams per litre	1	1	0.6	0.6	0.6
Lead	milligrams per litre	1	1	0.004	0.004	0.004
Magnesium	milligrams per litre	4	4	181	188.25	196
Manganese	micrograms per litre	1	1	0.082	0.082	0.082
Mercury	milligrams per litre	1	1	0.0001	0.0001	0.0001
Nitrate	milligrams per litre	1	1	0.01	0.01	0.01
Nitrite	milligrams per litre			0.01	0.01	0.01
Nitrogen (ammonia)	milligrams per litre	4	4	0.02	0.0275	0.04
Organochlorine pesticides	milligrams per litre	1	1	0.5	0.5	0.5
Organophosphate pesticides	milligrams per litre	1	1	0.5	0.5	0.5
pH	pH	4	4	6.6	6.725	6.9
Polycyclic aromatic hydrocarbons	milligrams per litre	1	1	1	1	1
Potassium	milligrams per litre	4	4	2	2.5	3
Sodium	milligrams per litre	4	4	583	602.75	599
Standing Water Level	meters	4	4	5.37	5.47	5.58
Sulfate	milligrams per litre	4	4	166	178.5	211
Toluene	milligrams per litre	1	1	2	2	2

Total dissolved solids	milligrams per litre	4	4	2830	3027.5	3380
Total organic carbon	milligrams per litre	4	4	1	4.25	8
Total petroleum hydrocarbons	milligrams per litre	1	1	50	50	50
Total Phenolics	milligrams per litre	1	1	0.05	0.05	0.05
Xylene	milligrams per litre	1	1	2	2	2
Zinc	milligrams per kilogram	1	1	0.035	0.035	0.035

Monitoring Point 9						
Groundwater quality monitoring, Monitoring point labelled GMW102 on Figure 15 titled "Current Site Investigation Locations" dated 6						
Pollutant	**Unit of Measure**	**No of samples required by licence**	**No. of samples collected and analysed**	**Lowest sample value**	**Mean of sample**	**Highest sample value**
Alkalinity (as calcium carbonate)	milligrams per litre	4	4	DRY	DRY	DRY
Aluminium	milligrams per litre	1	1	DRY	DRY	DRY
Arsenic	milligrams per litre	1	1	DRY	DRY	DRY
Barium	milligrams per litre	1	1	DRY	DRY	DRY
Benzene	milligrams per litre	1	1	DRY	DRY	DRY
Cadmium	milligrams per litre	1	1	DRY	DRY	DRY
Calcium	milligrams per litre	4	4	DRY	DRY	DRY
Chloride	milligrams per litre	4	4	DRY	DRY	DRY
Chromium (hexavalent)	milligrams per litre	1	1	DRY	DRY	DRY
Chromium (total)	milligrams per litre	1	1	DRY	DRY	DRY
Cobalt	milligrams per litre	1	1	DRY	DRY	DRY
Conductivity	microsiemens per centimeter	4	4	DRY	DRY	DRY
Copper	milligrams per litre	1	1	DRY	DRY	DRY
Ethyl benzene	micrograms per litre	1	1	DRY	DRY	DRY
Fluoride	milligrams per litre	1	1	DRY	DRY	DRY
Lead	milligrams per litre	1	1	DRY	DRY	DRY
Magnesium	milligrams per litre	4	4	DRY	DRY	DRY
Manganese	micrograms per litre	1	1	DRY	DRY	DRY
Mercury	milligrams per litre	1	1	DRY	DRY	DRY
Nitrate	milligrams per litre	1	1	DRY	DRY	DRY
Nitrite	milligrams per litre	1	1	DRY	DRY	DRY
Nitrogen (ammonia)	milligrams per litre	4	4	DRY	DRY	DRY
Organochlorine pesticides	milligrams per litre	1	1	DRY	DRY	DRY
Organophosphate pesticides	milligrams per litre	1	1	DRY	DRY	DRY
pH	pH	4	4	DRY	DRY	DRY
Polycyclic aromatic hydrocarbons	milligrams per litre	1	1	DRY	DRY	DRY
Potassium	milligrams per litre	4	4	DRY	DRY	DRY
Sodium	milligrams per litre	4	4	DRY	DRY	DRY
Standing Water Level	meters	4	4	DRY	DRY	DRY
Sulfate	milligrams per litre	4	4	DRY	DRY	DRY
Toluene	milligrams per litre	1	1	DRY	DRY	DRY
Total dissolved solids	milligrams per litre	4	4	DRY	DRY	DRY
Total organic carbon	milligrams per litre	4	4	DRY	DRY	DRY
Total petroleum hydrocarbons	milligrams per litre	1	1	DRY	DRY	DRY
Total Phenolics	milligrams per litre	1	1	DRY	DRY	DRY
Xylene	milligrams per litre	1	1	DRY	DRY	DRY
Zinc	milligrams per kilogram	1	1	DRY	DRY	DRY

Appendix K: Vegetation Management Plan

03/07/2017

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Dear Wayde

Re: Whytes Gully New Landfill Cell Vegetation Management Plan Review

Project no. 25059

Biosis Pty Ltd was commissioned by Wollongong City Council to review the existing Whytes Gully New Landfill Cell Vegetation Management Plan (VMP), prepared by Biosis (2013). The Whytes Gully New Landfill Cell is located at the Whytes Gully Resource Recovery Park, Kembla Grange (the 'study area').

Biosis understands that Council require an updated assessment of the current condition of the vegetation within the study area and the maintenance required to meet the performance criteria to date as outlined in the VMP (Biosis 2013). Performance criteria 'to date' has been based on the assumption that the proposed works program would currently be in year four, if the VMP had been implemented in 2014.

A field investigation was undertaken on 20 June 2017 by Botanist, Bianca Klein. This report details the results of the field investigation, including vegetation condition assessments and provides recommendations for management of the VMP site. Management actions have been formulated based on the requirement for each management zone, as outline in Biosis (2013), to satisfy the condition criteria outlined in the VMP to date. These management actions are proposed to be undertaken within a 12 month period, with consideration to the current condition of the site and the ongoing viability of the site during and after the VMP works.

Background

The study area is within the Wollongong Local Government Area (LGA) and covers approximately 13.2 hectares. The study area is located on public land approximately 1.5 kilometres north-west of Kembla Grange and approximately nine kilometres southwest of the Wollongong Central Business District. Waste from Wollongong LGA is processed and recycled at Whytes Gully Resource Recovery Park, operating within the study area.

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Biosis' previous vegetation survey identified remnants of native vegetation in varying states of condition. The majority of the native vegetation was assessed as being in poor condition, with the exception of small areas of the Endangered Ecological Communities (EECs); Illawarra Subtropical Rainforest in the form of Lowland Dry Subtropical Rainforest in Management Zone 2 and Illawarra Lowlands Grassy Woodland in the form of Forest Redgum Open Forest in Management Zone 3, both listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act) (Biosis 2012).

In summary the VMP (2013) included the following restoration works:

- 5.4 hectares of retained native vegetation in Vegetation Management Zones 2 and 3, including the EECs to be regenerated.
- 3.2 hectares of revegetation areas in Vegetation Management Zone 5.
- The partial regeneration (depending on rates of regeneration) of 4.6 hectares in Vegetation Management Zone 4.

Method

Database and literature review

Prior to completing the field investigation, key information was reviewed, including:

- Whytes Gully New Landfill Cell VMP (Biosis 2013).
- NSW DPI *Noxious Weeds Act, 1993* (NW Act) listed weeds for Wollongong City Council.
- Current aerial mapping of the study area.

Field investigation

A field investigation of the study area was undertaken on 20/6/2017 by Bianca Klein over a period of six hours. In areas where access to vegetation was possible on foot, the vegetation was assessed using the random meander technique (Cropper 1993). Areas in the south-eastern extent of the study area were unable to be safely accessed on foot due to restrictions associated with ongoing construction of the landfill cells. Where accurate assessment of vegetation condition was possible from within the vehicle, drive-by assessments were undertaken.

The focus of the vegetation assessments were to confirm the mapping of vegetation zone boundaries within the study area identified in the VMP (Biosis 2013), and to assess the current condition of the vegetation to provide suitable management actions to meet the outcomes to-date as stated in the VMP.

Results

Vegetation communities

The vegetation communities identified within the study area during field investigations included:

- Illawarra Subtropical Rainforest (Endangered, TSC Act)
- Illawarra Lowlands Grassy Woodland (Endangered, TSC Act)
- Acacia scrub
- Cleared/Exotic land

The vegetation management zones previously assigned to patches of vegetation based on their structure, floristic composition and condition are unchanged for the reviewed VMP (Figure 1, Appendix 1). The only exception being Management Zone 6, previously described as 'planted vegetation'. The recent field investigation did not find evidence of planted vegetation, however native remnant trees are present in this area. Therefore, management actions in Management Zone 6 are now focused on primary weed removal rather than maintenance of plantings as per the previous VMP. The dominant species composition for each of the vegetation management zones are outlined in Table 1. Representative images of each zone are included in Appendix 2.

Table 1 Dominant species composition of the vegetation management zones

Vegetation management zone	Vegetation composition – dominant species *Exotic, P: Planted, Common name/*Scientific name*			Reference plate
	Canopy	Mid-storey	Groundcover	
Zone 1 - Landfill area Acacia scrub and exotic grassland (poor condition)	Cleared	Cleared	Cleared	N/A
Zone 2 - Retained native vegetation Lowland Dry Subtropical Rainforest (TSC Act EEC *Illawarra Subtropical Rainforest*) (moderate-good condition)	Port Jackson Fig *Ficus rubiginosa* Red Cedar *Toona australis* Blackwood *Acacia melanoxylon* Giant Stinging Tree *Dendrocnide excelsa*	Water Vine *Cissus antarctica* Two-veined Hickory *Acacia binervata* Brush Kurrajong *Commersonia fraseri* Straggly Lantern-bush *Abutilon oxycarpum* Cabbage Palm *Livistona australis* *Lantana *Lantana camara* *Castor Oil Plant *Ricinus communis* *Wild Tobacco *Solanum mauritianum* *Turkey Rhubarb *Acetosa sagittata* *Cassia *Senna pendula var. glabrata*	Stinging Nettle *Urtica incisa* *Carex longebrachiata* Native Wandering Jew *Commelina cyanea* Weeping Grass *Microlaena stipoides var. stipoides* Basket Grass *Oplismenus aemulus* *Rhodes Grass *Chloris gayana* *Kikuyu *Pennisetum clandestinum* *Inkweed *Phytolacca octandra* *Fireweed *Senecio madagascariensis* *African Lovegrass *Eragrostis curvala*	Plate 1
Zone 3 – Retained native vegetation Forest Redgum Open Forest (poor condition)	Forest Red Gum *Eucalyptus tereticornis* Blackwood Black Wattle *Acacia mearnsii* Prickly-leaved Paperbark *Melaleuca styphelioides*	Black Wattle *Lantana *African Olive *Olea europaea subsp. cuspidata* *Morning Glory *Ipomoea purpurea*	Native Wandering Jew Kidney Weed *Dichondra repens* Basket Grass *Kikuyu *Paddy's Lucerne *Sida rhombifolia* *Fireweed *Rhodes Grass	Plate 2

Vegetation management zone	Vegetation composition – dominant species *Exotic, P: Planted, Common name/*Scientific name*			Reference plate
	Canopy	Mid-storey	Groundcover	
			*Veldt Grass *Ehrharta erecta* *Crofton Weed *Ageratina adenophora* *Purpletop *Verbena bonariensis*	
Zone 4 – northern patch Acacia scrub/exotic vegetation (poor condition)	Black Wattle Sydney Golden Wattle Port Jackson Fig	Prickly-leaved Paperbark Swamp She-oak *Casuarina glauca* Chainfruit *Alyxia ruscifolia* Straggly Lantern-bush *Lantana *Wild Tobacco *Crofton Weed *Small-leaved Privet *Castor Oil Plant	*Cape Ivy *Delairea odorata* *Rhodes Grass *Kikuyu *Narrow-leaved Cotton Bush *Gomphocarpus fruticosus* *Fireweed *African Lovegrass	Plate 3
Zone 4 – Southern patch Acacia scrub/exotic vegetation (poor condition)	Port Jackson Fig Sweet Pittosporum *Pittosporum undulatum* Black Wattle *African Olive	Sydney Golden Wattle Prickly-leaved Paperbark Brush Kurrajong *African Olive *Lantana *Cassia *Moth Vine *Araujia sericifera*	Native Wandering Jew Weeping Grass Basket Grass Cranesbill *Geranium homeanum* *Rhodes Grass *Kikuyu *Narrow-leaved Cotton Bush *Whisky Grass *Giant Parramatta Grass *Sporobolus fertilis* *Fireweed	Plate 3
Zone 5a - Designated revegetation areas	Black Wattle	Swamp she-oak Sydney Golden Wattle	*Kikuyu	Plate 4

Vegetation management zone	Vegetation composition – dominant species *Exotic, P: Planted, Common name/*Scientific name*			Reference plate
	Canopy	Mid-storey	Groundcover	
Acacia scrub/exotic vegetation (poor condition)		Prickly-leaved Paperbark		
Zone 5b – Designated revegetation areas Acacia scrub/exotic vegetation (poor condition)	Black Wattle Grey Ironbark *Eucalyptus paniculata* (P)	Black Wattle saplings *Wild Tobacco *Lantana	Bullrush *Typha australis* Spiny-headed Mat Rush *Lomandra longifolia* (P) *Kikuyu *Whisky Grass *Andropogon virginicus* *Crofton Weed *Purpletop *Blackberry *Rubus fruticosus aggregate*	Plate 4
Zone 6 Acacia scrub/exotic vegetation (poor condition)	Black Wattle Lily Pily *Acmena smithii* Cheese Tree *Glochidion fernandii*	Swamp She-Oak *Small-leaved Privet *Ligustrum sinense* *Lantana *Cassia	*Kikuyu *Crofton Weed *Rhodes Grass	Plate 5
Zone 7 Closed exotic grassland (poor condition)	Black Wattle	Sydney Golden Wattle *Lantana *Lantana camara*	Bullrush *Juncus usitatus* *Kikuyu *Whisky Grass *Crofton Weed *Purpletop *Cobbler's Pegs *Bidens pilosa*	Plate 6

Noxious weeds

Five exotic species recorded within the study area are declared noxious within the Wollongong City Council LGA (DPI 2017). The control class and legal requirements are outlined in Table 2. Appropriate control of these species within the management zones are to be prioritised.

Table 2 Noxious weeds within the study area (NSW Weed Control Order 2014)

Scientific name	Common name	Class	Legal requirements
Asparagus aethiopicus	Asparagus Fern	4	The plant must not be sold, propagated or knowingly distributed.
Lantana camara	Lantana	4	The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread.
Rubus fruticosus* subsp. *aggregate	Blackberry	4	The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed
Senecio madagascariensis	Fireweed	4	The plant must not be sold, propagated or knowingly distributed
Sporobolus fertilis	Giant Parramatta Grass	3	The plant must be fully and continuously suppressed and destroyed

Vegetation management

The recommended management actions have been adjusted according to Councils requirement for each Management Zone to meet the condition targets to date outlined in the VMP (Biosis 2013). Specifically, the management actions outlined in this report align with a more intensive weed control program to achieve the condition targets within a 12 month period.

Regeneration works are to be prioritised in the areas of vegetation in best condition; Management Zones 2 and 3 specifically, as these zones contain highest condition native vegetation remnants, including Illawarra Subtropical Rainforest EEC in Management Zone 2 and Illawarra Lowlands Grassy Woodland in Management Zone 3. Revegetation of Management Zones 5a and 5b should be undertaken using the plants provided in the recommended species lists provided in the VMP (Appendix 1, Biosis 2013).

The management actions for each Management Zone are outlined in Table 3 below. Refer to Appendix 3 for the proposed timeline for the recommended scope of works to achieve the performance criteria outlined in Table 3.

Table 3 Management objectives, actions and performance criteria for vegetation Management Zones within the study area

Vegetation management zone	Vegetation management objectives (Biosis 2013)	Management actions	Performance criteria (Biosis 2013)	Revised performance criteria to be achieved within 12 months
Zone 1 - Landfill area Acacia scrub and exotic grassland (poor condition)	Weed control, soil stabilization and erosion control by ensuring: • Primary weeds are removed. • Woody weeds are not allowed to re-establish. • Annual weeds are controlled and not allowed to recolonise disturbed areas.	• Primary weed control (mechanical). • Secondary weeding (spot spraying). • Spreading mulch. • Hydro seeding as required in areas closed for operation. • Utilise logs where available from clearing works to lay across the slope for soil stabilisation and fauna habitat. • Monitor and report on the regeneration program following 12 months of works.	• Primary weed removal is undertaken within 6 months of the commencement of the VMP works program. • Woody and annual weeds are not recolonising. • Bare soil is not left exposed and is covered with native plants, mulch or hydro seeded grasses.	• Primary weed removal is undertaken within 6 months of the commencement of the VMP works program. • Control noxious weeds. • Woody and annual weeds are not recolonising. • In closed operational areas ensure that bare soil is not left exposed and is covered with native plants, mulch or hydro seeded grasses. • Small trees, shrubs and grasses are establishing over the capped landfill area within 6 months of the landfill closure.
Zone 2 - Retained native vegetation Lowland Dry Subtropical Rainforest (TSC Act EEC *Illawarra Subtropical Rainforest*) (moderate-good condition)	• Minimise impacts during the construction phase. • Enhance the remnant patch of the Illawarra Subtropical Rainforest EEC as well as the adjoining Forest Redgum Open Forest. • Implement a bush regeneration program to enhance natural regeneration and control weeds.	• Implement primary and secondary weed removal throughout as well as maintenance weeding to ensure weeds do not reinvade. • Mechanical primary weed removal of woody weeds on the southern side of the concrete drainage channel only, keeping to at least 10 metres from native vegetation.	• Primary weed removal is completed within one year of the commencement of the VMP works program. • Annual weeds are controlled and not allowed to recolonise disturbed areas. • 50% or greater native vegetation cover in the ground layer by the end of year two.	• Primary weed removal to be completed within 6 months of commencement of works • Control of noxious weeds. • Lantana to be removed in stages, minimising erosion on steeper slopes. • Annual weeds are controlled and not allowed to recolonise disturbed areas.

Vegetation management zone	Vegetation management objectives (Biosis 2013)	Management actions	Performance criteria (Biosis 2013)	Revised performance criteria to be achieved within 12 months
	• Primary weed removal conducted to minimise fauna habitat loss and manage successional weed growth. • Enhance fauna habitat value. • Offset the impact of native vegetation and fauna habitat loss through the enhancement of retained native vegetation within the study area. • Control surface runoff erosion.	• Pile woody weeds onsite to mitigate fauna habitat loss. • Monitor and report on the regeneration program following 12 months of works.	• Native vegetation cover dominant in all structural layers and weeds limited to less than 10% cover in the ground layer at the end of year five. • Woody weed piles are no greater than 2 m across x 1.5 m high.	• At least 50% of native groundcover within 12 months. • Woody weed piles are no greater than 2 m across x 1.5 m high. • Revegetation, if required, in suitable areas after initial 12 months works program.
Zone 3 – Retained native vegetation Forest-Redgum Open Forest (poor condition)	• Minimise impacts during the construction phase. • Control weeds and enhance the native vegetation through bush regeneration techniques. • Primary weed removal conducted to minimise fauna habitat loss and manage successional weed growth. • Enhance fauna habitat value. • Offset the impact of native vegetation and fauna habitat loss through the enhancement of retained native vegetation within the study area. • Control surface runoff erosion.	• Implement primary and secondary weed removal throughout as well as maintenance weeding to ensure weeds do not reinvade. • Mechanical primary weed removal of woody weeds is appropriate for large areas of woody weeds where access can be gained taking care to avoid steep slopes and impacts to native vegetation. • Stage woody weed removal to maintain buffers of woody weeds at edges to manage weed growth and edge effects. • Pile woody weeds onsite to mitigate fauna habitat loss. • Stake logs, from native vegetation removal in zone 1, across steep slopes that have	• Retained native vegetation is intact and unharmed following adjacent vegetation clearance and primary weed removal. • Primary weed removal is completed in the third year of regeneration works. • Annual weeds are controlled before seeding and not allowed to recolonise disturbed areas. • 50% or greater native vegetation cover in the ground layer by the end of year three. • Native vegetation cover dominant in all structural layers and weeds limited to less than 10% cover in the ground layer at the end of year five.	• Primary weed removal to be completed within 6 months of commencement of works. • Control of noxious weeds. • Annual weeds are controlled before seeding and not allowed to recolonise disturbed areas. • 50% or greater native vegetation cover in the ground layer within 12 months. • Revegetation, if required, in suitable areas after initial 12 months works program.

Vegetation management zone	Vegetation management objectives (Biosis 2013)	Management actions	Performance criteria (Biosis 2013)	Revised performance criteria to be achieved within 12 months
		been cleared of woody weeds to minimise surface runoff erosion and create fauna habitat. • Monitor and report on the regeneration program following 12 months of works.	• Woody weed piles are no greater than 2 m across x 1.5 m high. • Logs are staked against slope securely and hold mulch and prevent erosion.	
Zone 4 Acacia scrub/exotic vegetation (poor condition)	• Control woody and annual weeds. • Primary weed removal conducted to minimise fauna habitat loss. • Control surface runoff erosion. • Retain native vegetation occurring. • Promote regeneration of native species within clumps of native vegetation. • Enhance fauna habitat values. • Offset the impact of native vegetation and fauna habitat loss through the enhancement of retained native vegetation within the study area.	• Implement strategic primary and weed removal. • Retain native vegetation (primarily *Acacia* sp.). • Mechanical primary weed removal of woody weeds is appropriate where access can be gained taking care to avoid steep slopes and impacts to native vegetation. • Slash open areas away from clumps of native vegetation. • Conduct secondary and maintenance weeding within clumps of native vegetation where regeneration is evident. • Stake logs, from native vegetation removal in zone 1, across steep slopes that have been cleared of woody weeds to minimise surface runoff erosion and create fauna habitat.	• Primary weed removal is completed in the third year of the Works Program. Annual weeds are controlled and not allowed to recolonise disturbed areas. • Woody weed piles are no greater than 2m x 1.5 m high. • Logs are staked against slope securely and hold mulch and prevent erosion. • Clumps or clusters of native regeneration are established.	• Control of noxious weeds. • Primary weed removal is strategically undertaken in areas directly surrounding native vegetation (*Acacia* sp.). • Woody weed piles are no greater than 2m x 1.5 m high. • Logs are staked against slope securely and hold mulch and prevent erosion. • Clumps or clusters of native regeneration are established.

Vegetation management zone	Vegetation management objectives (Biosis 2013)	Management actions	Performance criteria (Biosis 2013)	Revised performance criteria to be achieved within 12 months
		• Monitor and report on the regeneration program following 12 months of works.		
Zone 5 - Designated revegetation areas Acacia scrub/exotic vegetation (poor condition)	• Establish revegetation areas within the study area to enhance the habitat available for native flora and fauna species. • Control weeds. • Offset the impact of native vegetation and fauna habitat loss through revegetation to increase the area of native vegetation and the habitat this provides.	• Prepare areas to be planted by controlling weeds within six months. • Mulch to a minimum depth of 200 millimetres using chipped leaf mulch ensuring that the mulch is free of weed seed. • Revegetate using tree species representative of the appropriate native vegetation community. • Limit plantings within 10 metres of roads and access ways to shrubs and ground layer species. • Implement a maintenance program including maintenance weeding and irrigation of revegetation areas as required. • Monitor and report on the regeneration program following 12 months of works.	• Mulched vegetation from onsite is spread to 200 millimetres. • Logs are spread to create fauna habitat. • Species representative of the appropriate native vegetation community are used to revegetate these areas. • No trees are planted within 10 metres of roads or access ways. • 80% survival rate for plantings at the end of the five year works program. • Weed species are controlled and not allowed to recolonise open or disturbed areas.	• Control of noxious weeds. • Mulched vegetation from onsite is spread to 200 millimetres. • Logs are spread to create fauna habitat. • Revegetate areas after initial six months of weed control. • Species representative of the appropriate native vegetation community are used to revegetate these areas. • No trees are planted within 10 metres of roads or access ways. • Weed species are controlled and not allowed to recolonise open or disturbed areas. • Replacement planting after 12 months if required.

Vegetation management zone	Vegetation management objectives (Biosis 2013)	Management actions	Performance criteria (Biosis 2013)	Revised performance criteria to be achieved within 12 months
Zone 6 Acacia scrub/exotic vegetation (poor condition)	• Establish revegetation areas within the Study Area to enhance the habitat available for native flora and fauna species. • Control weeds.	• Implement strategic primary and weed removal. • Prepare open areas for revegetation – weed removal and control in first 6 months. • Monitor and report on the regeneration program following 12 months of works.	• Weed species are controlled and not allowed to recolonise open or disturbed areas.	• Control of noxious weeds. • Primary weed removal focused around native species. • Open areas are revegetated with appropriate native species after initial 6 months of weed removal/control. • Replacement planting after 12 months if required.
Zone 7 Closed exotic grassland (poor condition)	• Control weeds. • Provide habitat for native species particularly around dams to the south west of the study area where a variety of birds reptiles and amphibians inhabit dam edges.	• Continued slashing with the exception of a 10 metres buffer around dam edges. • Maintenance weeding throughout to target any woody weeds or listed noxious weed species.	• Slashing is conducted at least two times per annum, outside of buffer areas to the dams. • Woody weeds and any noxious weed species are controlled and not allowed to establish.	• Slashing is conducted at least two times per annum, outside of buffer areas to the dams. • Woody weeds and any noxious weed species are controlled and not allowed to establish.

Monitoring

Monitoring of the restoration works is required to ensure the management actions are implemented and performance criteria for each Management Zone are satisfied as far as possible. The monitoring program will begin with setting up photo monitoring points prior to the commencement of works. It is anticipated that the monitoring program will continue beyond the initial 12 months of works scoped in this report.

I trust that this advice is of assistance to you however please contact me if you would like to discuss any elements of this ecological advice further.

Yours sincerely

Klein

Bianca Klein

Field Botanist

References

Biosis 2012. Whytes Gully New Landfill Cell – Terrestrial and Aquatic Flora and Fauna Assessment. Prepared for Golder Associates PTY LTD. Author: B.Coddington, K.Reed and J.Dessmann.

Biosis 2013. Whytes Gully New Landfill Cell: Vegetation Management Plan. Prepared for Golder Associates PTY LTD. Author: B.Coddington.

DPI 2017. Noxious Weed Declarations: Wollongong City Council LGA.

Appendices

Appendix 1


(a) Revegetation to indicate species marked in (a) in recommended planting list (appendix 1)
(b) Revegetation to indicate species marked in (b) in recommended planting list (appendix 1)
Wollongong
Kiama
Nowra
Legend
Study Area
Lowland Dry Subtropical
Manangement Zones
Zone 1: Landfill area
Zone 2: Retained native vegetation (including moderate condition ISR)
Zone 3: Retained native vegetation (including poor condition ILGW)
Zone 4: Acacia scrub/Exotic vegetation
Zone 5: Designated revegetation areas
Zone 6: Acacia scrub/Exotic vegetation
Zone 7: Closed Exotic Grassland
Figure 1: Whytes Gully Vegetation Management Plan: Vegetation Management Zones
0 40 80 120 160 200
Metres
Scale: 1:4,113 @ A3
Coordinate System: GDA 1994 MGA Zone 56
biosis
Biosis Pty Ltd
Ballarat, Brisbane, Canberra, Melbourne, Sydney, Wangaratta & Wollongong
Acknowledgements: Imagery (c) Nearmap 2012

Appendix 2

Plate 1 Vegetation management zone 2 (contains EEC Illawarra Subtropical Rainforest)

Plate 2 Vegetation management zone 3a (Remnant native vegetation – Forest Redgum Open Forest)

Plate 3 Vegetation management zone 4 (Acacia scrub/exotics)

Plate 4 Vegetation composition within a designated revegetation zone (5)

Plate 5 Vegetation management zone 6

Plate 6 Vegetation management zone 7 (Closed exotic grassland)

Appendix 3

Table 4 Scope of works over a 12 month works program

Management zone	Management actions	Sequencing and timing of actions by month											
		1	2	3	4	5	6	7	8	9	10	11	12
Zone 1 Landfill area	Primary weed control (mechanical)	2 days		2 days		2 days							
	Secondary weeding (spot spraying)			1 day			1 day			1 day			1 day
	Spreading mulch				2 days			2 days					
	Hydro seeding intermediate cover	Immediately following intermediate cover. As required.											
Zone 2 Retained native vegetation (moderate-good condition)	Primary weed control (mechanical along bottom edge)	1 day											
	Primary weed control (manual)	3 days	8 days	8 days		4 days			4 days			2 days	
	Secondary Weeding			4 days	2 days	2 days	2 days	2 days	2 days	2 days	2 days	2 days	2 days
Zone 3 Retained native vegetation (poor condition)	Primary weed control (Mechanical)	1 day											
	Primary weed control (manual)		6 days	6 days	4 days		4 days			4 days			
	Secondary Weeding			4 days	2 days	2 days	2 days	2 days	2 days	2 days	2 days	2 days	2 days
Zone 4	Primary weed control (Mechanical)	1 day						1 day					

Management zone	Management actions	Sequencing and timing of actions by month											
		1	2	3	4	5	6	7	8	9	10	11	12
Acacia Scrub/Exotic (outside of landfill area)	Primary weed control (manual)	8 days		4 days		4 days							
	Secondary Weeding		2 days		2 days	2 days	2 days	2 days	2 days	2 days	2 days	2 days	2 days
	Stake logs across any unstable slopes				2 days			2 days					
Zone 5 **Designated revegetation areas**	Preparation of planting areas	5 days											
	Spreading mulch		4 days										
	Planting		12 days					2 days					
	Watering		4 days										
	Secondary weeding			2 days	2 days	2 days	2 days	2 days	2 days	2 days	2 days	2 days	2 days
Zone 6 **Acacia scrub/exotic**	Primary weeding	2 days			½ day			½ day			½ day		
	Secondary weeding		1 day	1 day	1 day	1 day	1 day	1 day	1 day	1 day	1 day	1 day	1 day
	Revegetation (if suitable)									5 days			
	Watering										2 days		
Zone 7 **Closed Exotic Grassland**	Slashing Grass			1 day			1 day			1 day			1 day
	Maintenance weeding (spot spraying)	1 day			1 day			1 day			1 day		